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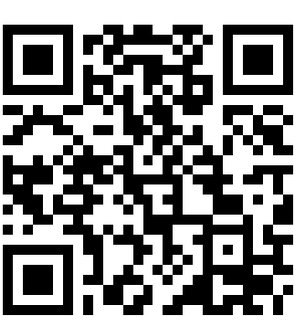

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AN ILLUSTRATED REVIEW OF PROGRESS IN
ELECTRIC AND OTHER TRACTION
WITH MOTOR TRAFFIC SECTION.

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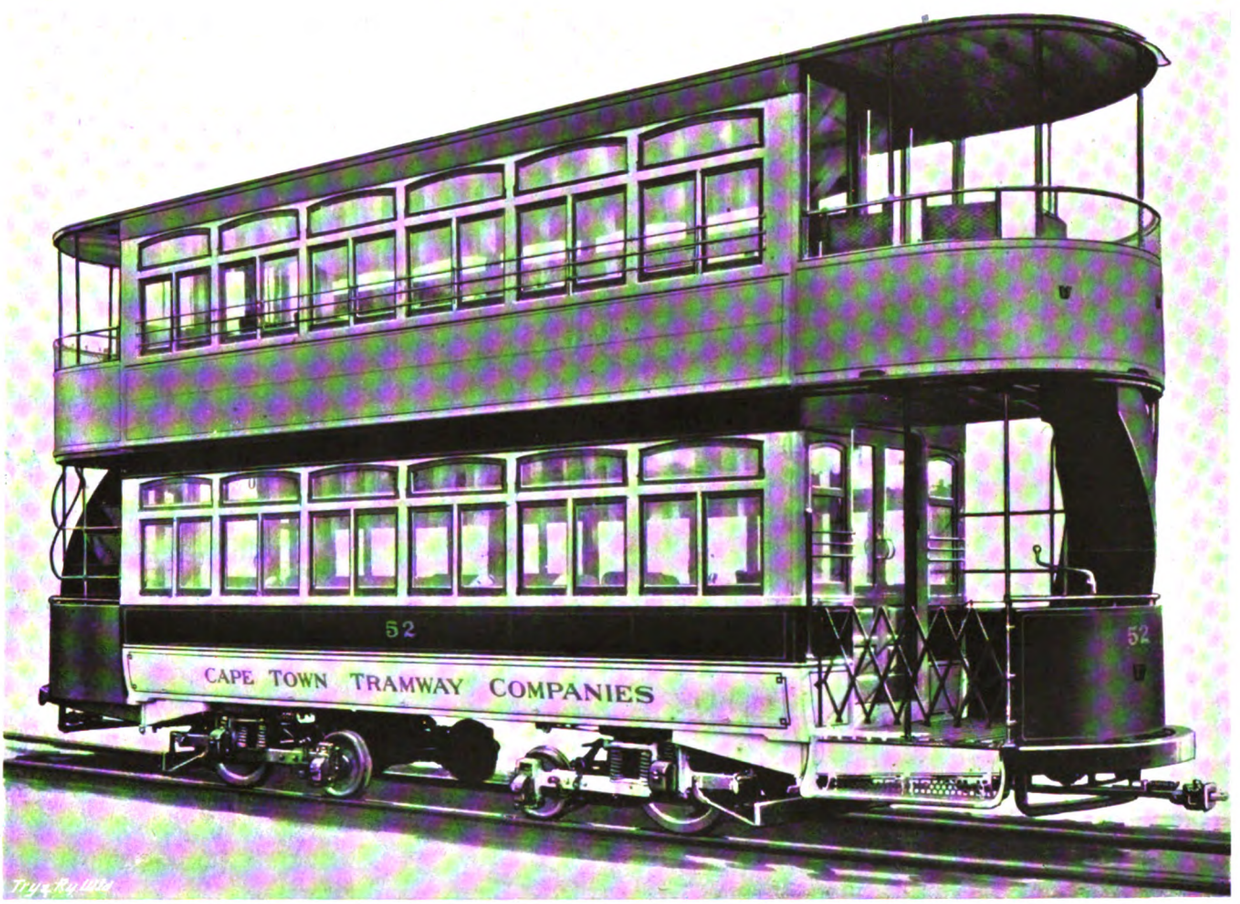
THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, JULY 15, 1920. VOL. XLVIII.

NEW CARS FOR CAPE TOWN TRAMWAYS.

The Cape Electric Tramways Limited have recently obtained from the J. G. Brill Company twelve double-deck cars for use in Cape Town. This type of car, the design of which is shown in accompanying views and drawings, is particularly interesting from the view point of the arrangement of the window sashes, its chief feature being a sliding sash in place of windows that raise or drop into wall-pockets. It was designed to obtain the maximum amount of light and air space, and also to permit seated passengers easily to operate the windows. As will be observed from the illustrations, the windows are in pairs separated by integral posts built into the side frame. One window of each pair slides across the face of the other, which is stationary. Over the top of each pair of windows a glass light is placed, this particular light also being arranged to hinge inwardly. The sliding sash is hung on a metal runway at the top, and is easily manipulated. To prevent cross draughts the windows are staggered, *i.e.*, one sliding sash is opposite a fixed sash on the opposite side of the car. This window arrangement is identical in both the upper and lower decks.



Double-Deck Bogie Car with Sliding Sashes—Cape Town Electric Tramways.

The car has a total seating capacity of 80 passengers, arranged for 32 in the lower deck and 48 in the upper. When required, the lower deck provides standing space for an extra 24 passengers and approximately another 15 on the upper deck, making a total accommodation of 120 passengers for this car, which measures 34 ft. 9 in. over bumpers. It will be noted that the cross seats of the lower deck are arranged with 2 ft. 8 in. centres,

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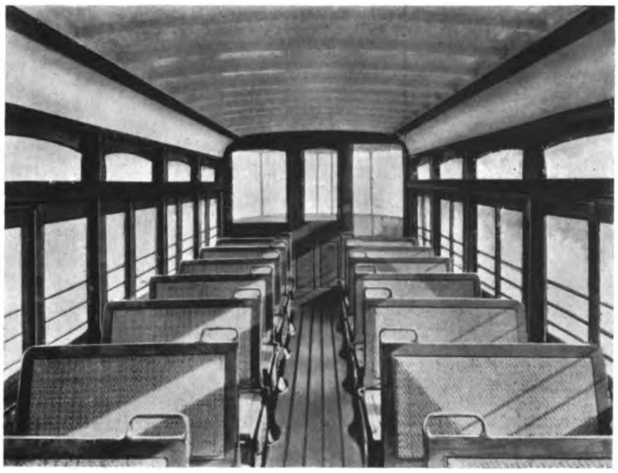
which provides a roomy interior, the seat centres on the upper deck being 2 ft. 3 in. apart.

A bulkhead with a sliding door is provided on the upper deck, and a stationary seat with fixed back against this bulkhead, accommodating three passengers, with two tip-up seats and a further stationary seat against the stairway.

The seats in the lower deck are of spring rattan, 32 in. long, and at the bulkheads longitudinal seats



Interior of Upper Saloon—Cape Town Car.

are placed to give ample clearance at the door opening. The seats on the upper deck are somewhat novel, it being desired to minimise as far as possible the weight in this upper section. Accordingly the Brill special light weight "Waylo" seat was employed, this having pressed steel mechanism, the seat cushions being wood framed, having sheet-steel panels both for seat cushion and back, neatly covered in rattan.

The general dimensions of this car as are follow:—

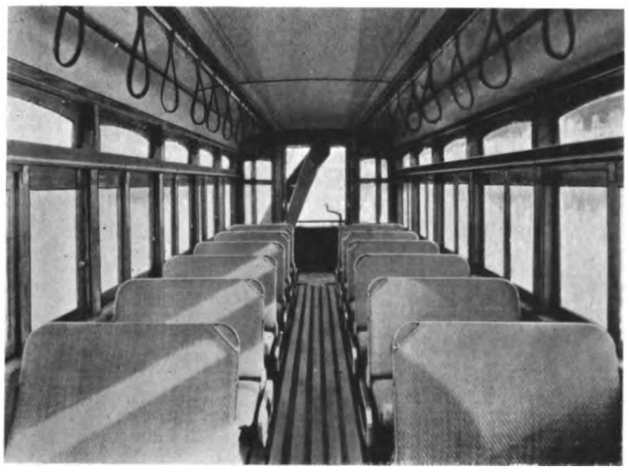
Length of car body over corner posts	22 ft. 4 in.
Length of platform from end of car body to outside of dashes	5 ft. 6 in.
Length of car body over platform dashes ...	33 ft. 4 in.
Length of car body over bumpers	34 ft. 9 in.
Pivotal centres of trucks	13 ft. 10 in.
Length of wheelbase of truck	4 ft. 0 in.
Length of seats in both lower and upper deck ...	2 ft. 8 in.
Width of car body over sills	6 ft. 11 in.
Width of car body over posts	7 ft. 5 in.
Width of car body over drip rail	7 ft. 5¾ in.
Width of car body over the upper deck roof ...	7 ft. 5⅞ in.
Height from rail to underside of sills	2 ft. 3½ in.
Height from rail to top of floor	2 ft. 9⅝ in.
Height from rail to top of lower deck	9 ft. 11¼ in.
Height from top of lower deck roof to top of trolley board on upper deck	6 ft. 9½ in.
Height from tail to top of trolley board on upper deck	16 ft. 8¾ in.
Height from rail to centre of drawbars	1 ft. 3 in.
Height from rail to top of step tread	1 ft. 1¾ in.
Height from top of step tread to platform floor ...	1 ft. 1 in.
Height from top of platform floor to car body floor	— 6⅜ in.
Width of aisle in both upper and lower deck ...	1 ft. 4 in.
Centre to centre of side posts in both upper and lower decks	3 ft. 6 in.
Seat centres in lower deck 2 ft. 8 in.; in upper deck	2 ft. 3 in.
Width of door opening in lower deck	3 ft. 0 in.

Bulkhead doors in the lower saloon are mutually operated, the width of the opening being 36 in. between doorposts, with a 6 ft. 0 in. height in the clear. These doors are neatly panelled with ash in the lower portion and glazed in the upper portion. Each platform from end of car body to outside of sheet steel dash is 5 ft. 6 in. in length, the platform being enclosed with No. 12 sheet steel dasher, the height of this dash being 2 ft. 9½ in. from platform floor. The step openings are provided with Brill iron opening gates.

The underframing of these cars is of composite steel and wood construction, with crossings of oak. This framing is stiffened with inside truss rods, so placed as to provide a rigid construction. The roof is plain arched the full length of the upper deck, whilst both the lower deck and upper deck are strengthened with concealed steel rafters.

The cars are provided with Brill "Hovey" radiating drawbars, Brill patented "dedenda" alarm gongs, also two Brill patented "dumpit" sandboxes, operated by levers from the platform. The metal trimmings in the car are of bronze. Curtains are provided in both upper and lower decks of "fabrikoid" material, arranged to slide into grooves in the posts.

The cars are mounted on the Brill patented 22-E maximum traction trucks, having 4 ft. 0 in. wheelbase, arranged for 33 in. driving wheels and 20 in. pony wheels. Brill patented half-ball brake hangers are fitted; the wheel brakes are operated by a bronze ratchet brake handle from the platform, the lower end of the shaft being provided with an Ackley adjustable brake gear. This shaft is also provided with an additional chain connected to the brake levers by a special attachment, and arranged to wind so that this second chain becomes taut when the main chain on the standard frame is wound to the full extent. This auxiliary attachment is provided so that in the event of the first chain failing, the second chain will maintain the same braking effect on the car. These particular



Interior of Lower Saloon—Cape Town Car.

trucks were furnished with magnetic track brakes, to permit of which the driving wheel brake shoes are outside-hung.

It will be noted that the panelling on the upper deck is continuous round the car, thus enhancing the appearance. Moreover, the sheathing outside the bulkhead is surmounted by a wire screen and rail, also in line with the bronze rails attached to the windows on the upper deck.

This car, without passengers or electrical equipment, mounted on the maximum traction trucks fitted with steel-tired wheels and axles, weighs about 24,600 lb. As an example of maximum passenger capacity with a total length of 34 ft. 9 in., this car is interesting, since it represents 308 lb. per seated passenger, or 205 lb. per passenger when filled to its capacity.

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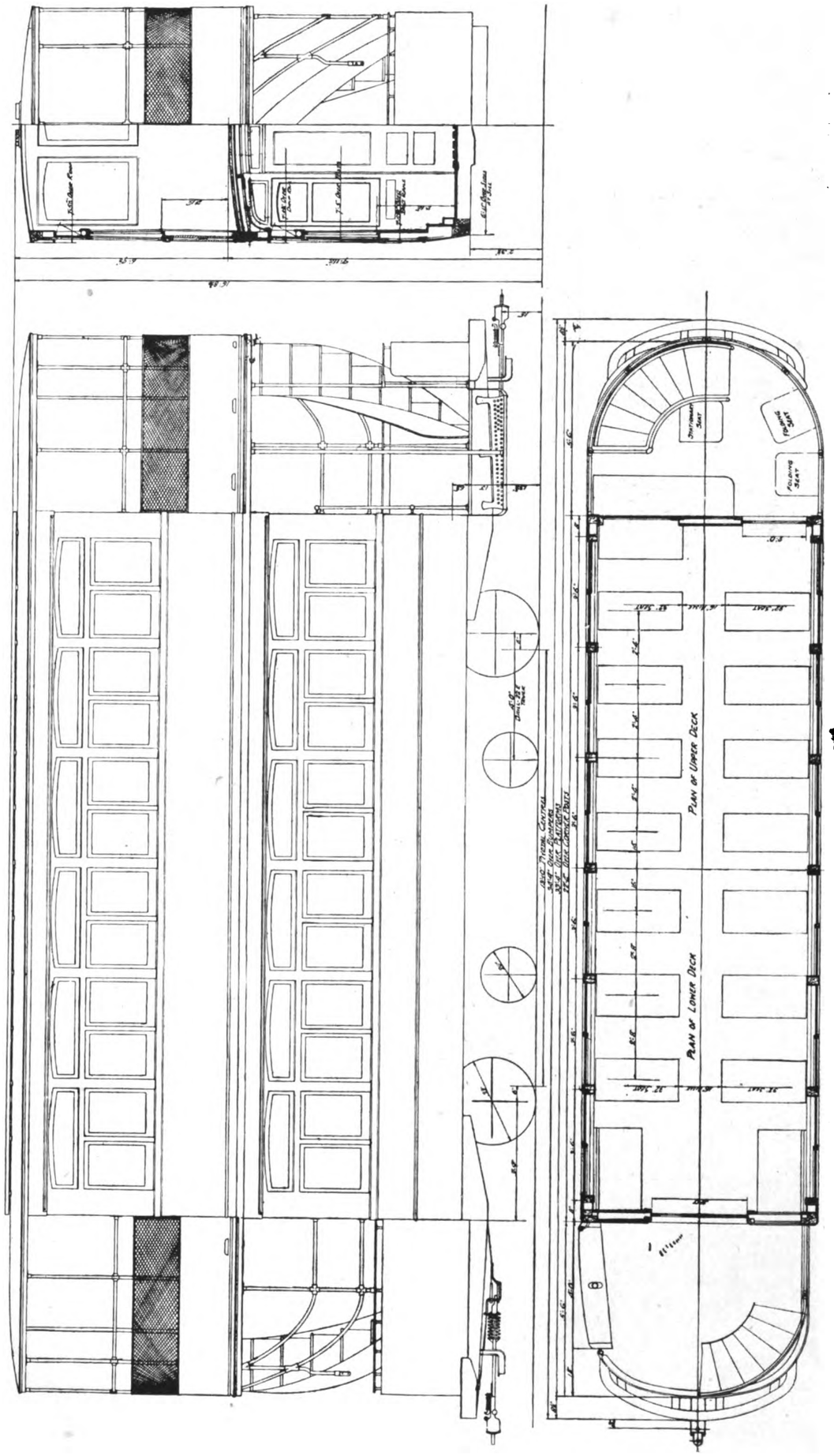

Plan and Elevations of Double-Deck Bogie Car—Cape Town Electric Tramways.

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THE POSSIBILITIES OF RAILLESS ELECTRIC TRACTION.

By R. H. Wilkinson
(*General Manager, Bradford Corporation Tramways*).

Up to the present railless vehicles have been considered as an auxiliary or adjunct to the main tramway service; but under present conditions the possibilities of a considerable extension of railless electric traction transportation appears very probable. Personally, I have been favourably impressed with the performance of these vehicles and can see a much brighter future in store for them. They have been in operation in this country for nine years, so that sufficient knowledge is available to enable a fairly correct estimate to be made as to their capabilities.

Attempts to improve their design have been hampered by the weight restriction imposed, viz., 5 tons loaded, and the uncertainty of the amounts they were called upon to contribute for road adaptation and maintenance. The weight restriction resulted in the vehicles being made of materials much too light to withstand the wear and tear of service, with the inevitable result—increased working expenses and frequent breakdowns. I am pleased to say that the Ministry of Transport a few months ago altered the weight restriction from 5 tons loaded to 5 tons unloaded, so that a more economical and reliable vehicle can now be made.

With regard to road adaptation and maintenance charges, there is every likelihood of these being superseded by a fixed charge per vehicle in accordance with the seating capacity, viz,. between 26 and 32 persons, £60 per annum; over 32 persons, £70 per annum. These recommendations are contained in an interim report of the Departmental Committee on Road Vehicles and the Finance Bill now before Parliament, which, if passed, will come into force on January 1 next. The amount this charge represents per car mile varies in accordance with the service, but will average between ½d. and 1d. This fixed charge per vehicle is much more satisfactory than the present erratic costs they have to bear, and enables a more accurate estimate to be formed of their operating costs.

In Bradford, the working costs are higher than they would be with properly constructed vehicles, but nevertheless are approximately 4d. per mile less than those of the tramcar. This lesser operating cost is due very largely to the lighter weight of the railless vehicles and their running on more level roads.

In arriving at the operating costs every conceivable charge has been included and in many of the items, where it has not been practicable to obtain actual costs, the proportionate amount borne by the tramcars has been included, which, on close investigation, would be found to exceed the actual costs incurred by these vehicles. No reserve fund has been formed to draw upon, all renewals being paid for out of revenue as required.

From the experience gained with the present type of vehicle, I am able to submit an approximate estimate of the cost of construction and operation of a new route, one estimate being for tramcars and the other for railless vehicles, with a view to indicating up to what density of traffic the railless vehicle is the more economical. This estimate is based on a double-deck top-covered railless vehicle seating 51 and a tramcar seating 60 passengers.

The present railless services are working at 4d. per mile less than the tramcar as already indicated, but by increasing the seating capacity of the railless from 29 to 51 and running it on busier routes and over our usual tramcar gradients, the working expenses, exclusive of interest and sinking fund charges, would probably be equal to those of the tramcar, but in order to be on the safe side I will assume that they will exceed those of the tramcar by 2d. per car mile; that is, increasing the present working expenses of the railless by 6d. per car mile.

The following table shows only those costs which vary with the different types of vehicle; the working costs common to both are ignored as not affecting the result. I have added 1·35d. to the expenses of the railless to compensate for its decreased earning capacity, as it seats nine less than a tramcar, this amount being arrived at in the following manner.

A railless car seats 51, a tramcar 60. The seating capacity of the former is, therefore, 15 per cent. less than a tramcar, but only at busy times when cars are full. This occurs for, say, 15 per cent. of the time the cars are in service, and taking 120 miles as the daily mileage per car, its decreased earnings per mile amount to 15 per cent. of 120 miles at 9d. (at fare rate of 1d. per mile) equals 13s. 6d. per day, or 1·35d. per car mile over the total miles run.

Comparable Costs of Construction and Operation of Tramways and Railless for One Mile of Route.

Tramway.		Railless.
Permanent way ...	£25,000	
Overhead equipment ...	4,000	
		Overhead equipment £4,500
Single line ...	£29,000	
Double line ...	£54,000	

Service mins.	Miles per year.	Per Car Mile. (a) Interest and sinking fund costs. Single track.	Per Car Mile. (b) Interest and sinking fund costs. Double track.	Per Car Mile. Extra working costs of railless and allowance for less seating capacity.	Interest and sinking fund costs.	Comparable figures with "a" and "b."
20	40,000	13·9d.	25·9d.	3·35d.	2·16d.	5·51d.
15	53,000	10·4d.	19·4d.	3·35d.	1·62d.	4·97d.
10	80,000	6·95d.	12·95d.	3·35d.	1·08d.	4·43d.
7½	106,600	5·2d.	9·7d.	3·35d.	·81d.	4·16d.
5	160,000	3·47d.	6·47d.	3·35d.	·54d.	3·89d.
4	200,000	2·78d.	5·18d.	3·35d.	·43d.	3·78d.
3	266,000	2·08d.	3·88d.	3·35d.	·324d.	3·67d.
2	400,000	1·39d.	2·59d	3·35d.	·216d.	3·56d.

According to the table the more economical vehicle is the railless up to approximately a five minutes' service on a single-line tramway, and a three minutes' service on a double-line tramway.

There are other things to consider in addition to costs, such as (1) Are railless cars as comfortable as tramcars? (2) Would the liability to accidents and collisions be greater, especially when descending steep gradients? (3) Are they as reliable as tramcars?

In answer to the first question, I would say that the railless cars are not as comfortable to ride in as tramcars, providing the tramway permanent way is kept in good condition. The reply to the second question is somewhat doubtful; railless cars are liable to skid on snow, and not having a defined track are more likely to collide with other vehicles in foggy weather. In answer to the third question, the present vehicles are certainly not so reliable as the tramcars, but can be made so. On the other hand, they possess certain

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advantages over tramcars—(1) A vehicle breaking down does not interfere or cause any delay to the other vehicles in service; (2) they can draw closer to the side walk for loading and unloading; (3) make considerably less noise than a tramcar; (4) offer greater facilities for inter-running.

Another direction in which the railless vehicle is likely to prove of considerable benefit is in the carriage of parcels and goods. For the past 18 months a railless vehicle (designed by my predecessor, Mr. C. J. Spencer), fitted with batteries to enable it to run without the aid of trolley wires, has been in constant daily service between Leeds and Bradford, a distance of nine miles, conveying parcels and making two trips per day since October last. Previously, it ran only one trip per day. The vehicle carries 2½ tons and its working expenses last year, exclusive of road charges, amounted to 18·7d. per car mile, or including interest and sinking fund, 22·5d., which is equal to 7s. 6d. per hour. Had two trips per day been run for a longer period the cost per mile would have been reduced.

BRADFORD CORPORATION TRAMWAYS

Operating Cost and Comparative Statement, Eleven Months ended March 2, 1920.

Account No.	Account.	Tramways. Average per car mile	Tramways. £ s. d.	Railless Average per car mile	Railless £ s. d.	Railless Battery Vehicle. Average per car mile	Railless Battery Vehicle. £ s. d.
	Traffic Expenses.						
1	Superintendence	·041	819 19 7	·041	59 14 9	·041	1 10 7
2	Wages of motormen and conductors	6·247	125,136 14 2	6·188	9,029 18 5	11·843	442 1 0
3	Wages of other traffic employees and bonus	·302	6,046 0 0	·302	440 9 2	—	—
4	Cleaning and oiling of cars	1·060	21,228 7 11	·593	865 7 3	·024	0 18 1
5	Cleaning, salting and sanding track	·338	6,789 17 6	—	—	—	—
6	Fuel, light and water for depots	·198	3,952 10 4	·198	287 19 0	·406	15 3 1
7	Ticket check	·405	8,116 10 9	·405	591 6 0	—	—
8	Uniforms and badges	·243	4,862 0 7	·243	354 4 1	·282	10 10 8
9	Miscellaneous	·154	3,089 7 3	·152	222 12 2	·314	11 14 4
		8·988	180,641 8 1	8·122	11,851 10 10	12·910	481 17 9
	General Expenses.						
10	Salaries of general officers and staff, and administration expenses	·452	9,046 1 8	·452	659 0 5	·452	16 17 5
11	Store expenses	·041	818 15 0	·041	59 12 11	·041	1 10 7
13	Rates and taxes	·761	15,248 5 6	·259	377 19 0	·259	9 13 4
14	Printing and stationery	·056	1,118 19 4	·056	81 10 4	·056	2 1 10
15	Fuel, light and water for offices	·024	478 14 11	·024	34 17 7	·024	0 17 11
16	Law charges (*Nil*)	—	—	—	—	—	—
17	Accidents, investigation and compensation	·214	4,286 5 8	·075	109 1 4	·075	2 16 0
18	Fire and other insurances	·013	273 12 10	·013	19 18 9	·028	1 1 0
19	Miscellaneous	·101	2,029 18 4	·101	147 17 8	·101	3 15 5
		1·662	33,300 13 3	1·021	1,489 18 0	1·036	38 13 6
	General Repairs and Maintenance.						
20	Permanent way	1·609	32,227 18 2	·375	547 4 5	No road	charge included.
21	Electrical equipment of line	·299	5,979 4 4	·285	416 5 0	·285	10 12 9
22	Buildings and fixtures	·103	2,062 19 8	·103	150 5 10	·212	7 18 2
23	Workshop tools and sundry plant	·112	2,252 18 11	·112	164 2 7	·112	4 3 7
24	Car repairs	4·149	83,100 1 11	4·681	6,830 15 7	2·538	94 14 4
25	Other rolling stock	·053	1,062 14 11	—	—	—	—
26	Miscellaneous equipment	·004	77 6 5	—	—	—	—
—	Social club	·003	63 11 4	·003	4 12 8	—	—
		6·332	126,826 15 8	5·559	8,113 6 1	3·147	117 8 10
	Power Expenses.						
27	Cost of current	3·254	65,190 16 8	1·749	2,552 17 3	1·630	60 16 6
	Allowances to dependants of soldiers, etc.	·239	4,779 1 5	·239	348 3 3	—	—
	Total	20·475	410,138 15 1	16·690	24,355 15 5	18·723	698 16 7
	Interest on loans (estimated)	·529	10,586 16 1	·496	723 19 3	*1·508	56 6 0
	Sinking fund	1·215	24,336 12 6	·865	1,262 13 11	2·277	85 0 0
	Rent of leased lines	·149	2,992 2 0	—	—	—	—
	Income tax (estimated)	·837	16,772 4 11	—	—	—	—
	Other charges	·002	46 1 3	—	—	—	—
		2·732	54,733 16 9	1·361	1,986 13 2	3·785	141 6 0
	Grand Total	23·207	£464,872 11 10	18·051	£26,342 8 7	22·508	840 2 7
	Mileage		4,807,328		350,221		8,959
	Receipts		£518,557 18s. 7d.		£17,010 1s. 2d.		—
	,, per car mile		25·888d.		11·656d.		—
	Profit or loss		£53,685 6s. 9d. (profit)		£9,332 7s. 5d. (loss)		—
	,, per car mile		2·680d.		6·395d.		—
	Units consumed		10,575,780		431,352		9,732
	,, ,, per car mile		2·200d.		1·231d.		1·086d.

* On £1,000—fifteen years' life of vehicle, also for use of Depots, etc., and overhead equipment.

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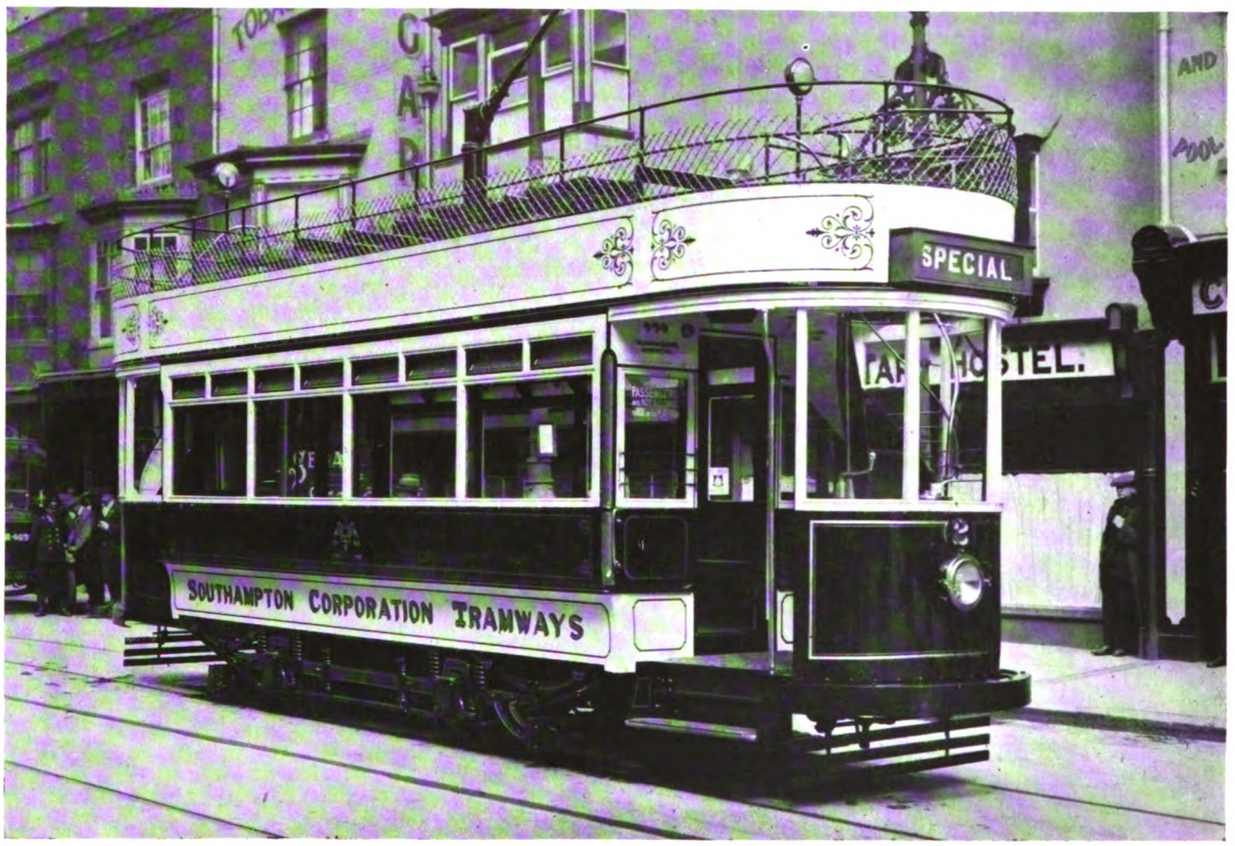
SOUTHAMPTON'S STANDARD CAR.

IMPROVEMENTS IN COMFORT AND CAPACITY.

A tramcar of new design, which the Southampton Corporation Tramways general manager and engineer, Mr. James Dobson, hopes will eventually become the standard for Southampton, has been put into service. This car is the first one with top-deck "garden" seats to pass under the Southampton Bargate. It was specially designed to this end. The advantage of these seats, placed across the breadth of the car, leaving ample space down the centre, will be manifest to anyone who has struggled over the feet and bunched-up knees of his fellow passengers when trying to get off one of the present type of cars, with its back-to-back seats running the whole length of the vehicle.

Another important point is the increased carrying capacity of the new car. It has seating for twenty-six and standing room for ten inside, with seating for forty-three outside, a total carrying capacity of 79, as against the old car's 52. It is claimed that the seating of the new car is more comfortable than that of the old. This increased comfort is obtained by the seats being a trifle deeper, with a slightly different curve.

As will be seen from the photograph, the car has glass screens at each end, affording the driver and conductor protection from the weather. The body is longer than the old car, the total length being 31 feet, as compared with 26 ft. 6 in. It is only one and a quarter inches lower inside. There is, however, still 6 ft. 2 in. of head space in the centre of the car, and as there is practically the same head space at the side, instead of the roof being brought sharply down, as in the old cars, the slight decrease in height is not noticeable. Two 40 H.P. Dick-Kerr motors provide motive power, giving a maximum speed of 15 miles per hour. Another car of this type is approaching completion, and the management hope to produce more later.



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Mr. Alfred Baker, general manager of Birmingham Corporation Tramways, who acted as adviser to the Wolverhampton Council, in a report to the committee said—"The Lorain system has undoubtedly served the town well in the past, but it cannot be gainsaid that from an operating point of view all the advantages lie with the overhead system. Indeed, the only advantage the Lorain system can claim is that it obviates the necessity of erecting tramway standards. It is open to question whether in an industrial town this single advantage can or ought to be set against the numerous advantages attaching to the overhead system."

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Sir Charles Mander (chairman), in supporting the recommendations, said that the tramways had contributed £461,000 in relief of rates in the last ten years. There is a reserve fund of £35,000 and a special fund of £20,000, which will be required for maintenance of the track during the conversion. The universal adoption of the overhead system made the change requisite in order that there might be through running.

Councillor Jenks said that Wolverhampton was isolated with the present system, and this was an increasing menace to the prosperity of the town.

Alderman Craddock declared that the Lorain system was guaranteed for 14 years and had been in service for 18 years, but there must be intercommunication with Birmingham, the Black Country, etc.

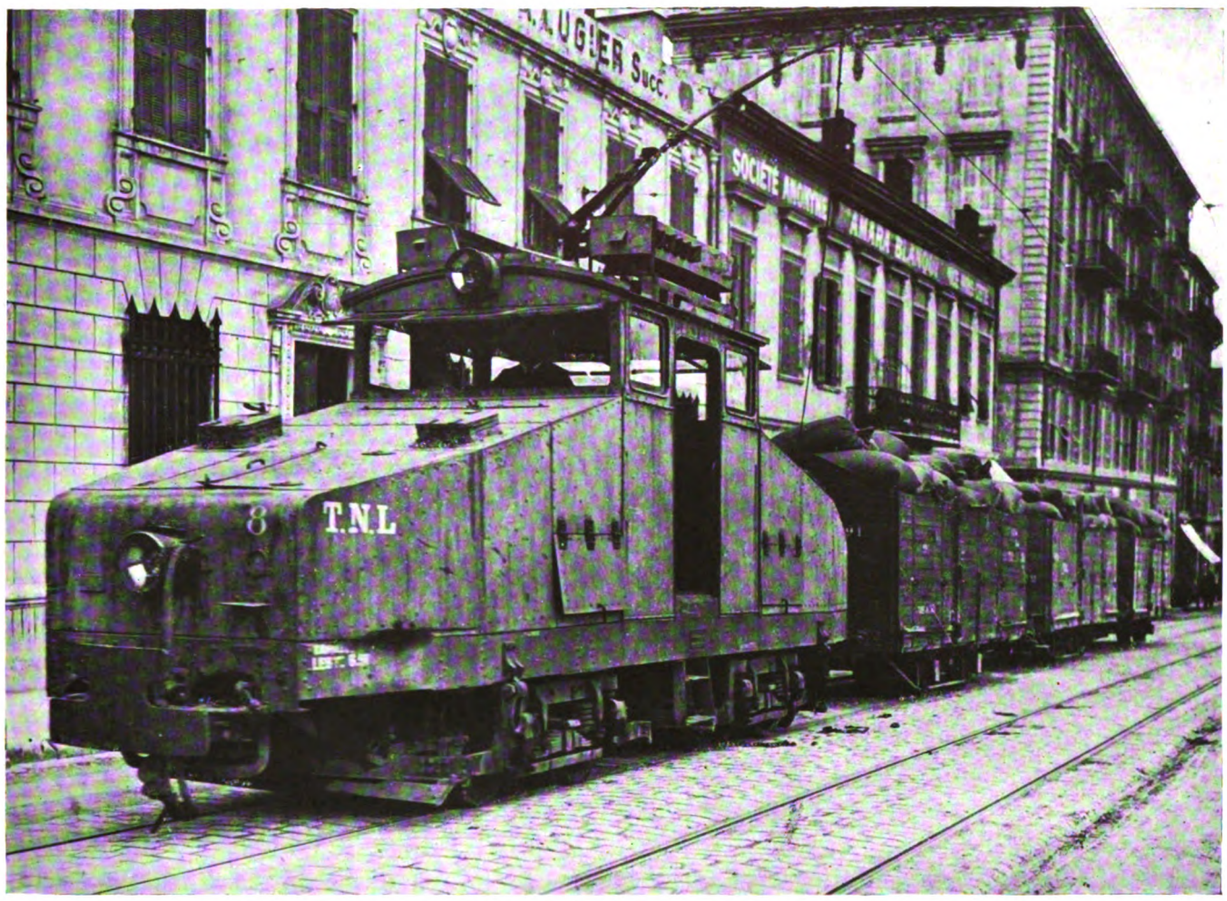
A proposal to substitute omnibuses for the tramways was defeated.

RAIL TARIFF AFFECTS AUSTRALIAN TRAMWAYS.

Schemes of tramway development in the Commonwealth are, the *Melbourne Herald* says, likely to be checked, if not crippled, by the extra duties placed in the new tariff upon imported rails. Duties on all steel rails, including tramway rails, have been raised from 17s. 6d. to 35s. and 65s. a ton, according to country of origin. While these duties are intended to give extra protection to Australian manufacturers, it is pointed out that owing to plant suitable for the manufacture of rails not being available it will be impossible for some time to draw supplies from Australian sources.

TRAMWAY GOODS SERVICE AT NICE.

For many years the company working tramways in Nice and vicinity have provided a goods service which has been of great advantage to the community. The amount of goods handled has steadily increased and the work done affords an excellent illustration of the way in which tramways can be used to assist local traders and at the same time obtain additional revenue, which in these days of increased costs of material and higher wages is so vitally necessary. In Nice a considerable business is done in the carriage of parcels by means of light wagons attached to the rear of a certain number of cars or trains, for trailer cars are common. In addition, goods trains are regularly run, consisting of an electric locomotive and two to five goods cars. Large quantities of coal are conveyed from the quay at the port of Nice to the gas works, while there is a considerable traffic to the cement works at Contes, about nine miles from Nice. The trains sometimes have a total weight of 138 tons and carry about 80 tons of paying load. The accompanying photograph, recently taken at Nice, shows a train bringing material from the cement works to the port. The electric locomotive was constructed by the French Thomson-Houston Company, weighs about 25 tons, and is able to handle trains of 80 tons over a gradient of 1 in 33.



A Tramway Goods Train in the Streets of Nice.

The goods service has been in operation since 1909 and has never given rise to any complaint, either from the public authorities or residents, although the trains pass through the centre of Nice and are run at all times of the day.

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Tramway and Railway World

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, JULY 15, 1920.

Interrupted Electrification.

The announcement that the directors of the London and South Western have been obliged to postpone the electrification of the lines from Cobham and Leatherhead to Guildford will come as an unpleasant surprise to those who have been anticipating vast extension of the electrical industry. These lines were to have been the next step in the South Western electrification scheme, and their postponement entails the indefinite interruption of their whole programme. The principal causes necessitating this decision are the high prices of electrical equipment of all kinds, the refusal of manufacturers to give firm quotations or to guarantee early deliveries, but above all the impossibility of raising fresh capital in the present condition of uncertainty that surrounds the railway industry. The question of prices and delivery will solve itself in due course as production increases and the demand falls off in this manner, but the third ground is more vital; money must be obtained if any such programmes are to go forward. Of the desirability and public importance of railway electrification there can be no question; its advantages under the heads of efficiency, economy, and comfort have been demonstrated conclusively. The Ministry of Transport is understood to regard progress in this direction as essential; its committees have been deliberating upon the technical aspect, and there has been talk of substantial subsidies in aid. In view of the present demands for public economy, however, little is to be expected in this direction, and as Sir Eric Geddes foreshadowed at the first annual dinner of the Institute of Transport, the companies will be expected to raise their own capital. How they are to do this in the face of the Minister's white paper issued shortly afterwards it is difficult to understand. It is here suggested that wages and rates shall be so correlated as to allow a margin of profit to the companies, but little thought seems to have been given to the point at which an increase in rates will entail a decrease in receipts, the empty train problem which the Ministry has even now to face. In the event of the continuation of the present loss on working, the Government repudiates all responsibility towards the shareholders from whom they received the railways as a paying concern. If, however, private enterprise succeeds where unified control has failed, and an increased profit results, a portion of this is to be taken by the central authority as a subsidy towards new enterprise in undeveloped districts. These draft proposals, unencouraging as they appear, are by no means definite, and there is no indication as to when a final settlement may be expected. So long as suspense of this nature is allowed to continue it is useless to hope for any important advance in this country. In the meantime electric traction is making progress in the United States, in France, Switzerland, Italy, and even in Austria. Unless immediate steps are taken to regularise the position we shall run the risk of being hampered by the lack of transport facilities enjoyed by our neighbours.

Traffic Research.

In acknowledging the bestowal of the honorary degree which was conferred upon him at Sheffield University, Sir Eric Geddes expressed the hope that a Degree of Transport would be instituted in the University. Doubtless in years to come courses of study arranged for that object will be one of the results of the formation of the Institute of Transport; but meanwhile much advantageous work remains to be done by traction

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authorities in the preparation of the ground. One direction was indicated in a paper read by Mr. C. J. Spencer at the annual meeting of the Tramways and Light Railways Association. In his American tour Mr. Spencer found that on most undertakings a traffic research department of considerable dimensions was deemed an essential part of the organisation. As a result greater efficiency of working has been achieved, particularly in adjusting schedules to meet the development and fluctuations of traffic. The problem of the schedule maker is to secure the adjustments without incurring unreasonable working hours for the employees, and on some undertakings this task has been reduced to a science. In recommending the study of this subject to the managers of tramways, Mr. Spencer declared that the schedule maker can save his thousands or equally well waste them. In view of the present unsatisfactory financial condition of tramway operation in this country, another remark made by Mr. Spencer deserves to be noted. It is, as he says, a common arrangement in America to employ an economy officer, whose sole duty is to study every phase of working for the purpose of securing economy of operation. The utmost use of labour-saving machinery is made in every department. Mr. Spencer found that the cost of permanent way construction in the States is less than in this country, owing to the use of machines for tearing up the roadway, digging the trench, mixing concrete, etc. With many of the leading tramway authorities in this country, faced with the need for extensions on account of housing developments, there is good reason why managers should prevail on their committees to permit the use of these appliances, of the existence of which they have long been aware. Another machine breaks up concrete foundations that require relaying. This invention could be turned to further profitable use in the reconstruction of roads for modern traffic. At present this task is being laboriously carried out with hammer and chisel in many towns. Mr. Spencer could not in a brief paper cover the whole field for traffic research, but he said enough to set even the lukewarm thinking. Nor could he stop to give honour where honour is due in this country. The meteorological and schedule augmenting department of the London General Omnibus Company has attained a degree of perfection not seen anywhere else in the world. In part this progress is due to the limitations of the vehicle operated, a circumstance that strengthens the plea for research.

Car Types and Economy.

The one-man safety car received much attention in the two papers submitted to the meeting of the Tramways and Light Railways Association. No higher praise of its merits could be desired than was given by Mr. Spencer. His discerning inquiry into its working in the United States convinced him that it has nearly doubled the headways, thus calling for the running of more cars. Thus it was not a question, he found, of dispensing with men, but one of giving the public a better service and the company an improved result. And incidentally it has put the petrol jitneys out of service. To sum up, the one-man vehicle is popular with the public, with the management, and with the men who drive it and collect the fares. Mr. Spencer emphasised a reservation to its use in this country; he considers that there must be a simple fare collection system. As an aid towards the solution of the fare problem the particulars of the methods adopted by Mr. Pringle, on the Ballarat and Bendigo systems of the Electric Supply Company of Victoria, afford valuable data. While not looking for the reduction of nearly 50 per cent. in operating costs effected in many cases in the States, Mr. Pringle considers that it is possible to obtain a reduction of nearly half in platform costs. As proof of this we have his statement that the company's premiums for third party insurance have been reduced 40 per cent. Objections raised by the employees at the outset have been satisfactorily met. Speaking from his knowledge of British tramway working, Mr. Pringle advises the adoption of the one-man car for small undertakings working under serious financial strain, and also on non-paying and light traffic routes of the larger undertakings. Existing single-deck cars could be converted at no great cost, the chief requirement being hinged gates at each end of the car on both sides. Mr. Spencer does not stand alone in his opinion that the double-deck car body needs improvement. Practical steps towards that end ought to be

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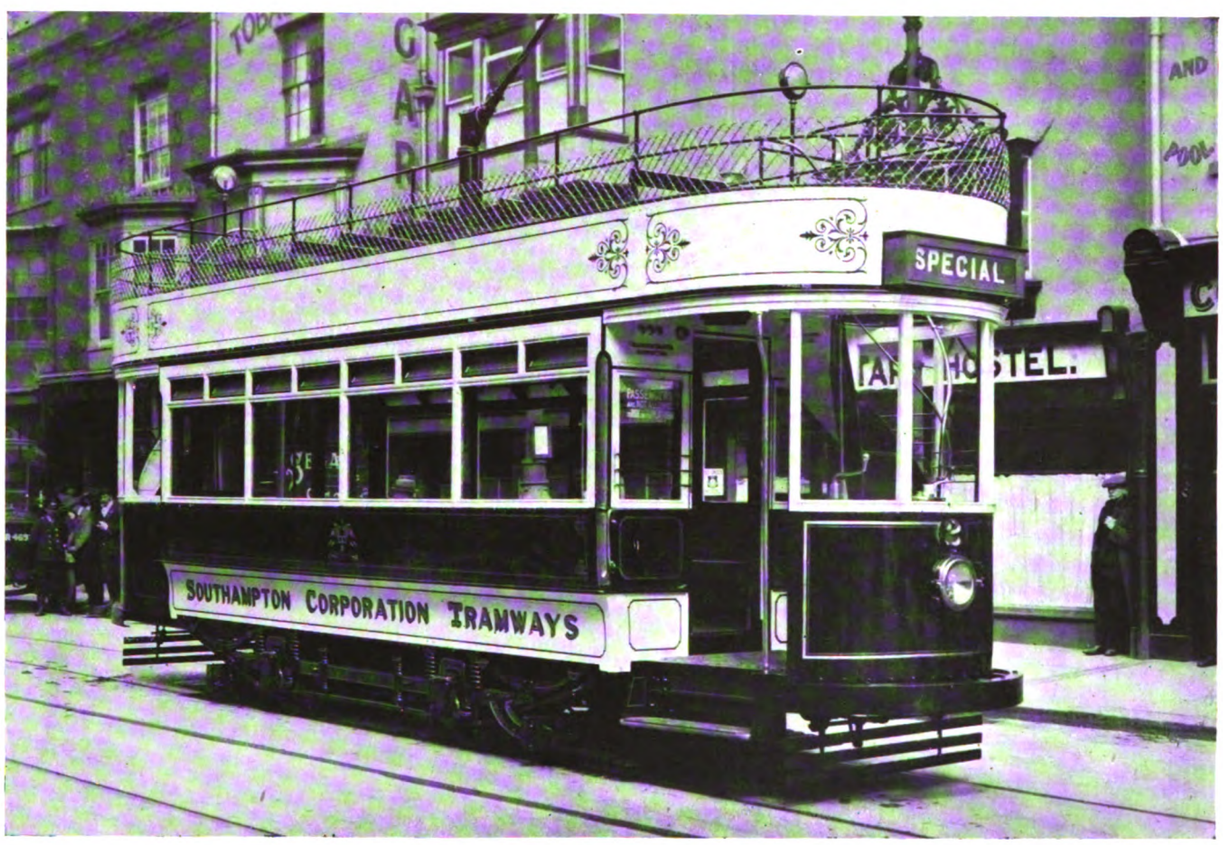

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Mr. Alfred Baker, general manager of Birmingham Corporation Tramways, who acted as adviser to the Wolverhampton Council, in a report to the committee said—"The Lorain system has undoubtedly served the town well in the past, but it cannot be gainsaid that from an operating point of view all the advantages lie with the overhead system. Indeed, the only advantage the Lorain system can claim is that it obviates the necessity of erecting tramway standards. It is open to question whether in an industrial town this single advantage can or ought to be set against the numerous advantages attaching to the overhead system."

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Sir Charles Mander (chairman), in supporting the recommendations, said that the tramways had contributed £461,000 in relief of rates in the last ten years. There is a reserve fund of £35,000 and a special fund of £20,000, which will be required for maintenance of the track during the conversion. The universal adoption of the overhead system made the change requisite in order that there might be through running.

Councillor Jenks said that Wolverhampton was isolated with the present system, and this was an increasing menace to the prosperity of the town.

Alderman Craddock declared that the Lorain system was guaranteed for 14 years and had been in service for 18 years, but there must be intercommunication with Birmingham, the Black Country, etc.

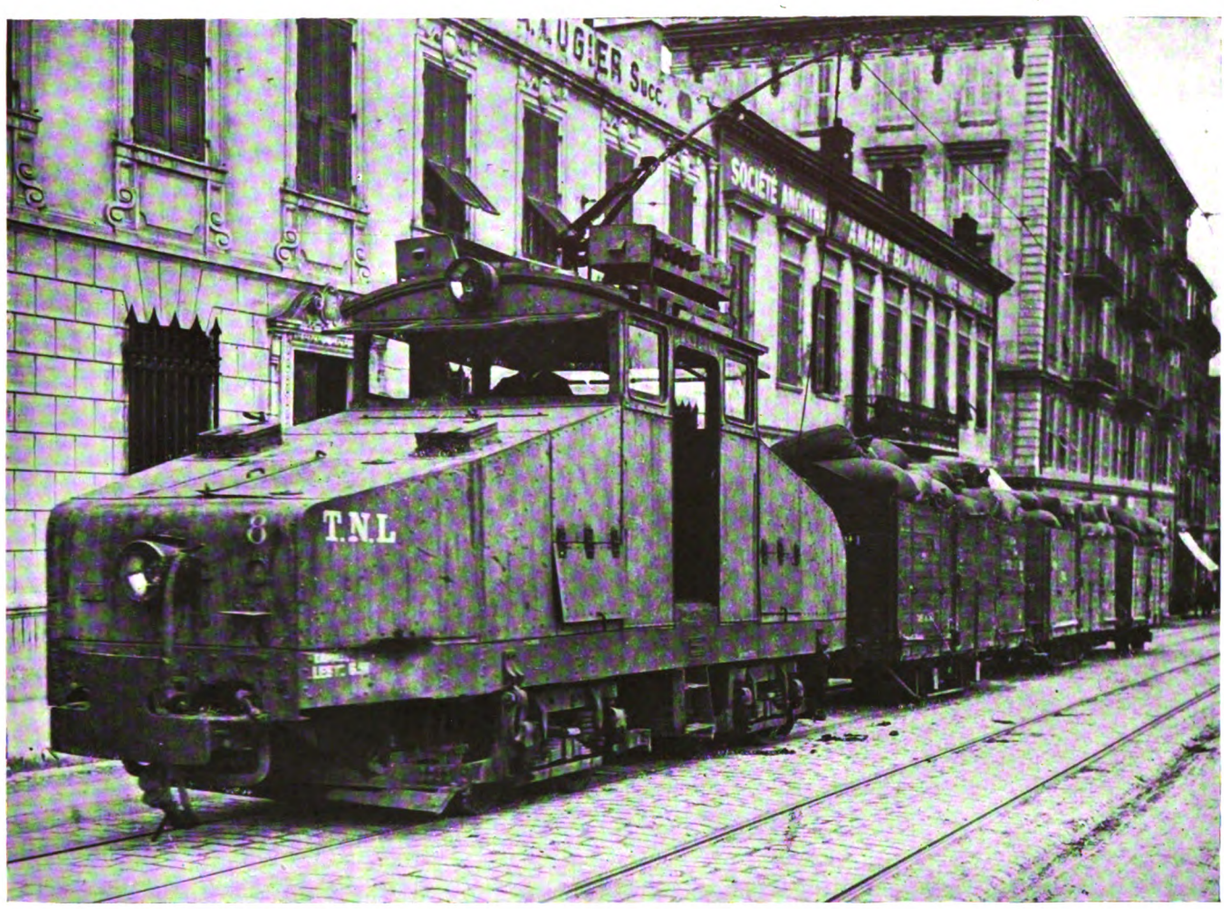
A proposal to substitute omnibuses for the tramways was defeated.

RAIL TARIFF AFFECTS AUSTRALIAN TRAMWAYS.

Schemes of tramway development in the Commonwealth are, the *Melbourne Herald* says, likely to be checked, if not crippled, by the extra duties placed in the new tariff upon imported rails. Duties on all steel rails, including tramway rails, have been raised from 17s. 6d. to 35s. and 65s. a ton, according to country of origin. While these duties are intended to give extra protection to Australian manufacturers, it is pointed out that owing to plant suitable for the manufacture of rails not being available it will be impossible for some time to draw supplies from Australian sources.

TRAMWAY GOODS SERVICE AT NICE.

For many years the company working tramways in Nice and vicinity have provided a goods service which has been of great advantage to the community. The amount of goods handled has steadily increased and the work done affords an excellent illustration of the way in which tramways can be used to assist local traders and at the same time obtain additional revenue, which in these days of increased costs of material and higher wages is so vitally necessary. In Nice a considerable business is done in the carriage of parcels by means of light wagons attached to the rear of a certain number of cars or trains, for trailer cars are common. In addition, goods trains are regularly run, consisting of an electric locomotive and two to five goods cars. Large quantities of coal are conveyed from the quay at the port of Nice to the gas works, while there is a considerable traffic to the cement works at Contes, about nine miles from Nice. The trains sometimes have a total weight of 138 tons and carry about 80 tons of paying load. The accompanying photograph, recently taken at Nice, shows a train bringing material from the cement works to the port. The electric locomotive was constructed by the French Thomson-Houston Company, weighs about 25 tons, and is able to handle trains of 80 tons over a gradient of 1 in 33.



A Tramway Goods Train in the Streets of Nice.

The goods service has been in operation since 1909 and has never given rise to any complaint, either from the public authorities or residents, although the trains pass through the centre of Nice and are run at all times of the day.

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THE
Tramway and Railway World

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, JULY 15, 1920.

Interrupted Electrification.

The announcement that the directors of the London and South Western have been obliged to postpone the electrification of the lines from Cobham and Leatherhead to Guildford will come as an unpleasant surprise to those who have been anticipating vast extension of the electrical industry. These lines were to have been the next step in the South Western electrification scheme, and their postponement entails the indefinite interruption of their whole programme. The principal causes necessitating this decision are the high prices of electrical equipment of all kinds, the refusal of manufacturers to give firm quotations or to guarantee early deliveries, but above all the impossibility of raising fresh capital in the present condition of uncertainty that surrounds the railway industry. The question of prices and delivery will solve itself in due course as production increases and the demand falls off in this manner, but the third ground is more vital; money must be obtained if any such programmes are to go forward. Of the desirability and public importance of railway electrification there can be no question; its advantages under the heads of efficiency, economy, and comfort have been demonstrated conclusively. The Ministry of Transport is understood to regard progress in this direction as essential; its committees have been deliberating upon the technical aspect, and there has been talk of substantial subsidies in aid. In view of the present demands for public economy, however, little is to be expected in this direction, and as Sir Eric Geddes foreshadowed at the first annual dinner of the Institute of Transport, the companies will be expected to raise their own capital. How they are to do this in the face of the Minister's white paper issued shortly afterwards it is difficult to understand. It is here suggested that wages and rates shall be so correlated as to allow a margin of profit to the companies, but little thought seems to have been given to the point at which an increase in rates will entail a decrease in receipts, the empty train problem which the Ministry has even now to face. In the event of the continuation of the present loss on working, the Government repudiates all responsibility towards the shareholders from whom they received the railways as a paying concern. If, however, private enterprise succeeds where unified control has failed, and an increased profit results, a portion of this is to be taken by the central authority as a subsidy towards new enterprise in undeveloped districts. These draft proposals, unencouraging as they appear, are by no means definite, and there is no indication as to when a final settlement may be expected. So long as suspense of this nature is allowed to continue it is useless to hope for any important advance in this country. In the meantime electric traction is making progress in the United States, in France, Switzerland, Italy, and even in Austria. Unless immediate steps are taken to regularise the position we shall run the risk of being hampered by the lack of transport facilities enjoyed by our neighbours.

Traffic Research.

In acknowledging the bestowal of the honorary degree which was conferred upon him at Sheffield University, Sir Eric Geddes expressed the hope that a Degree of Transport would be instituted in the University. Doubtless in years to come courses of study arranged for that object will be one of the results of the formation of the Institute of Transport; but meanwhile much advantageous work remains to be done by traction

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authorities in the preparation of the ground. One direction was indicated in a paper read by Mr. C. J. Spencer at the annual meeting of the Tramways and Light Railways Association. In his American tour Mr. Spencer found that on most undertakings a traffic research department of considerable dimensions was deemed an essential part of the organisation. As a result greater efficiency of working has been achieved, particularly in adjusting schedules to meet the development and fluctuations of traffic. The problem of the schedule maker is to secure the adjustments without incurring unreasonable working hours for the employees, and on some undertakings this task has been reduced to a science. In recommending the study of this subject to the managers of tramways, Mr. Spencer declared that the schedule maker can save his thousands or equally well waste them. In view of the present unsatisfactory financial condition of tramway operation in this country, another remark made by Mr. Spencer deserves to be noted. It is, as he says, a common arrangement in America to employ an economy officer, whose sole duty is to study every phase of working for the purpose of securing economy of operation. The utmost use of labour-saving machinery is made in every department. Mr. Spencer found that the cost of permanent way construction in the States is less than in this country, owing to the use of machines for tearing up the roadway, digging the trench, mixing concrete, etc. With many of the leading tramway authorities in this country, faced with the need for extensions on account of housing developments, there is good reason why managers should prevail on their committees to permit the use of these appliances, of the existence of which they have long been aware. Another machine breaks up concrete foundations that require relaying. This invention could be turned to further profitable use in the reconstruction of roads for modern traffic. At present this task is being laboriously carried out with hammer and chisel in many towns. Mr. Spencer could not in a brief paper cover the whole field for traffic research, but he said enough to set even the lukewarm thinking. Nor could he stop to give honour where honour is due in this country. The meteorological and schedule augmenting department of the London General Omnibus Company has attained a degree of perfection not seen anywhere else in the world. In part this progress is due to the limitations of the vehicle operated, a circumstance that strengthens the plea for research.

Car Types and Economy.

The one-man safety car received much attention in the two papers submitted to the meeting of the Tramways and Light Railways Association. No higher praise of its merits could be desired than was given by Mr. Spencer. His discerning inquiry into its working in the United States convinced him that it has nearly doubled the headways, thus calling for the running of more cars. Thus it was not a question, he found, of dispensing with men, but one of giving the public a better service and the company an improved result. And incidentally it has put the petrol jitneys out of service. To sum up, the one-man vehicle is popular with the public, with the management, and with the men who drive it and collect the fares. Mr. Spencer emphasised a reservation to its use in this country; he considers that there must be a simple fare collection system. As an aid towards the solution of the fare problem the particulars of the methods adopted by Mr. Pringle, on the Ballarat and Bendigo systems of the Electric Supply Company of Victoria, afford valuable data. While not looking for the reduction of nearly 50 per cent. in operating costs effected in many cases in the States, Mr. Pringle considers that it is possible to obtain a reduction of nearly half in platform costs. As proof of this we have his statement that the company's premiums for third party insurance have been reduced 40 per cent. Objections raised by the employees at the outset have been satisfactorily met. Speaking from his knowledge of British tramway working, Mr. Pringle advises the adoption of the one-man car for small undertakings working under serious financial strain, and also on non-paying and light traffic routes of the larger undertakings. Existing single-deck cars could be converted at no great cost, the chief requirement being hinged gates at each end of the car on both sides. Mr. Spencer does not stand alone in his opinion that the double-deck car body needs improvement. Practical steps towards that end ought to be

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forthcoming as the result of the £1,000 premium offered by the London County Council. Evidently Mr. Spencer would like to introduce either the one-man car or the ordinary single-deck on some sections of the Greater London tramways of which he is the manager, for he invited operators to furnish him with information on the advantages and disadvantages of single and double deck vehicles, including the earning value expressed in pence per car-mile. The London County Council figures relating to the subway cars and to the single-deck cars running from Waterloo Station to the Tower would have notable interest as bearing on such services in districts of heavy traffic. A further interesting return would be one giving the results of trailer working in London. By the adoption of a single-deck motor car with the double-deck trailer attached it would be possible to give a through service from the Embankment to the southern terminus of the Croydon Corporation lines, instead of stopping short at the Croydon boundary on account of the London Council cars being too heavy for the Croydon track and too high to pass under a railway bridge. This extended use of trailers would be advantageous to both undertakings at a time when economical working is imperative, to say nothing of ensuring public convenience and safety.

THE INSTITUTE OF TRANSPORT.

The first annual dinner of the Institute of Transport, which was held at the Automobile Club on June 25, was in every way a very successful occasion. Few similar associations can point to so great a success achieved in so short a space of time as the new Institute. It was formed less than a year ago, but has steadily grown in membership until to-day it numbers over 600, and there can be no doubt that it will prove an invaluable aid in the development of transport in this country and in the solution of many new problems with which the industry is now faced.

Sir Eric Geddes, Minister of Transport, presided at the annual meeting, and over 250 members, including a few guests, attended. These included the Right Hon. Edward Shortt, K.C., M.P., Home Secretary; Mr. Arthur Neal, M.P., secretary of the Ministry of Transport; Sir Gilbert Claughton, chairman of the London and North Western Railway Company; the Right Hon. the Earl of Bessborough, K.P., chairman of the London, Brighton and South Coast Railway; the Right Hon. Viscount Knaresborough, chairman of the North Eastern Railway; the Right Hon. Lord Riddell, Sir John Courtis, president of the Municipal Tramways Association; the Hon. Arthur Stanley, G.B.E.; and Sir Sam Fay, general manager of the Great Central Railway; Sir Henry Maybury, K.C.M.G., C.B.; Sir Joseph Broodbank, Sir Lynden Macassey, K.B.E., K.C.; Sir J. G. Beharrel, and Messrs. A. L. C. Fell, G. A. Dutfield, F. Tatlow, R. H. Selway, and others.

The speeches were of unusual interest. Sir Edward Shortt, in proposing the toast of the Institute of Transport, said that some twelve months ago it was his duty and pleasure to assist Sir Eric Geddes in passing the Bill that created the Ministry of Transport. He was satisfied that the Institute was very necessary, and an essential complement to that Ministry. It was a Ministry with new ideals and with new methods, but these were born of advanced knowledge, advanced experience, and advanced ideals of our time. To carry out this great work they must have growing up just the very men which this Institute would be able to produce. The Institute might well collect and assimilate the knowledge of transport derived from all countries. The Ministry required men of the highest possible expert knowledge and experience. How could the country get the right men unless they paid salaries that would attract the best men; who would be encouraged to give their talents and experience to the State? He believed that between the Ministry and the Institute a great deal would be done. Everyone of the members believed that there was a very great future before transport, whether by road, rail, or sea, or even by air.

Sir Eric Geddes said they were all working for an ideal. If they believed what they read in the paper he was working for it by the use of statistics, but whether by statistics or by doing something more practicable they were working for an ideal of scientific, economical transport. The Ministry of Transport was designed to meet a very abnormal situation, but it was going through the test, and the Institute of Transport was going through the test with it. Referring to the medals to be awarded tri-annually by the Institute for papers read, he thought that a very good beginning had been made. In regard to roads and to taxation it has been said that whatever was best for roads, most practicable and best for road users, that system they would adopt. The system of taxation by means of petrol was no longer sufficient. They had thrown their weight and influence in favour of a system of taxation of vehicles. The proposal was not ideal, but it was the best system of raising money for roads in the present financial condition of the country. There would be eight millions per annum, in addition to the twenty millions which local authorities provided. As to railways, he believed the country would treat its railways in the way they ought to be treated, and allow them to amalgamate, as all the great railways had tried to do. Transportation was the servant of the community, and must be helped by the community; and the Institute of Transport, with its objects and its ideals, could aid materially. Some day he believed that through the medium of the Institute of Transport transportation would become a profession, and there would be degrees of transportation, graduates of transportation, men who had made it their life's study.

The Hon. Sir Arthur Stanley proposed the "Transport Ministry" in an amusing speech.

Sir Gilbert Claughton, chairman of the London and North Western Railway, replied, and offered Sir Eric Geddes the support of the railways. The companies knew what transport meant, and they would do their best to do their duty toward the new Ministry.

Sir Henry Maybury proposed "Our Guests," and Sir Lynden Macassey proposed the toast of "The Press," to which Lord Riddell replied.

The following list of premiums, which may, however, be subject to revision, has been provisionally approved by the Council of the Institute of Transport—

Institute Medal.—Gold medal awarded triennially for the paper read, or contribution to proceedings made, during the preceding three years, judged first in order of merit.

Railways.—Two gold medals (donors, the Railway Companies' Association) awarded annually for best paper or contribution on railway (*a*) operating and (*b*) engineering subjects.

Road Transport.—Two gold medals (donors, the Commercial Motor Users' Association and London Underground Railways and London General Omnibus group) awarded annually for the best paper or contribution on road transport subjects, goods and passenger respectively.

Tramways and Light Railways.—Gold medal awarded annually for the best paper or contribution on subjects relating to tramways and light railways.

Water Transport.—Gold medal awarded annually for best paper or contribution on subjects relating to inland waterways, docks, or coastwise shipping.

Contributions or offers should be forwarded by September 30, and papers or contributions will be submitted for examination to the Proceedings and Library Committee. The Council is to be recommended to award annually two silver medals, one each for the best paper or contribution submitted by a graduate and by a student.

BIRMINGHAM OMNIBUSES FREE OF DEBT.

The accounts of the Birmingham Corporation Tramways and Omnibus undertaking for the year ended March 31, last, show that the receipts and expenses in connection with the motor omnibuses show a slight increase as compared with the previous year. The balance of the account, viz., £16,053, is carried to the profit and loss account, as compared with the previous year's balance of £16,963. The committee express gratification that the whole of the expenditure on the omnibus undertaking has now been paid off out of revenue. There are 46 omnibuses in service.

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Tramways & Light Railways Association.

Annual Congress held in London, July 3, 1920.

NOTES ON TRANSPORTATION IN AMERICA. :: AUSTRALIAN EXPERIENCE.

The twenty-third ordinary general meeting of the members of the Tramways and Light Railways Association was held on Friday, July 2, 1920, at the Caxton Hall, Westminster, S.W.1, Mr. R. J. Howley, C.B.E. M.Inst.C.E., presiding.

The Secretary (Mr. A. de Turckheim, O.B.E.) read the notice convening the meeting and the auditor's certificate.

The Chairman moved the adoption of the report of the Council and the accounts for the year ended December 31, 1919, which showed that the Association was in a satisfactory financial condition. He mentioned that during the year four of their company members were taken over by the respective local authorities, viz., Blackpool and Fleetwood Tramroad Company, Edinburgh and District Tramways Company, St. Helens, and Barrow, and then briefly reviewed the work done by the Association during the year.

THE CHAIRMAN'S REVIEW OF THE YEAR.

I shall begin by expressing, what I feel sure will be your unanimous wish, our very sincere thanks to our President, Viscount Chilston, upon his relinquishing that position, for the honour and pleasure he has given us by being our President since March, 1913. We sincerely appreciate what he has done for us, and I am pleased to be able to inform you that at the earnest request of your Council Lord Chilston consents to become one of our Vice-presidents, so that we shall not lose him altogether, and we hope that during many long years to come we may have the pleasure of seeing him at our annual gatherings.

I have further to inform you that owing to pressure of work our chairman, Sir Arthur Stanley, has found it necessary to ask to be relieved of the duties of chairman of the Council. You will remember that in April, 1905, he was elected our president, and in November, 1906, when the Association was partially reconstructed, he resigned that position in favour of the late Duke of Argyle, and became our chairman of Council instead. He has been our chairman ever since, nearly 14 years. Well, we found we simply could not allow Sir Arthur Stanley to go, and you will all be delighted to hear that he has accepted his former post, now once more vacant, i.e., that of president of this Association. (Applause.) We shall doubtless have an excellent opportunity of congratulating him and ourselves at the annual dinner to-night.

I shall now proceed with the work of the Association during 1919. At the beginning of that year we were still engaged in obtaining an early release from H.M. Forces of those pivotal men whose return the various tramway managers were calling for and generally during the first few months of the year with demobilisation matters. As in the previous year, practically the whole of the energies of the Association were taken up with labour matters. In March, the now famous agreement of March 29, 1919, between the two tramway associations and the unions was signed, and no sooner was it signed than an interpretation committee had to be set up which was kept busy explaining and translating its provisions. This is perhaps not to be wondered at, as the document is one of the greatest importance to tramways, constituting a species of charter such as had not previously existed. During the year a further demand was made by the unions for an increase of 12s. to the existing war bonus, which then stood at 30s. A prolonged inquiry took place, the Court sitting successively in London, Bristol, Manchester, Glasgow, and again in London, the result being announced in Award 805, which gave the men an additional 4s., bringing up the total war bonus to 34s. in October, 1919. During the latter portion of the year, the National Joint Industrial Council took over the duties of the interpretation committee, and held monthly sittings in London. As you know, District Councils were set up for nine areas, and these bodies are now all at work. The further increases granted and the new demands made on behalf of the men belong to the 1920 period, which we are not discussing to-day.

Several legislative measures were passed during the year which more or less closely affected the tramway industry, and in all these the Council of the Association took an active interest. Chief among these measures were the Electricity (Supply) Bill. The associations were successful in obtaining an amendment which provided safeguards against the compulsory purchase of power stations. This feature of the Bill, however, was dropped at the end of the session, and the Act as it now stands does not deal with compulsory purchase. The Ministry of Ways and Communications Bill, now the Ministry of Transport Act, 1919, affects tramways very considerably. Most of the powers formerly held by the Board of Trade are by it transferred to the new Ministry of Transport. Other measures passed were the Acquisition of Land (Assessment of Compensation) Act, 1919, the Courts Emergency Powers Act, 1919, National Health Insurance Act, 1919, and the Industrial Courts Act, 1919. The following Bills, however, were not passed :—Compensation for Subsidence Bill, Minimum Rates of Wages Commissions Bill, and the Hours of Employment (No. 2) Bill.

With regard to the King's National Roll, from replies received from 48 companies, it appears that the average number of disabled ex-service men in proportion to the total number of employees amounts to 9 per cent. of the total. Special committees of the Council were engaged on the following matters :—Standardisation of rails, tyres, axles and wheel centres, folding steps for tramcars, knee aprons for motormen, electrical vehicles, defective eyesight, etc., and workmen's compensation. During the year twenty further Orders were granted to tramway undertakings under the Statutory Undertakings (Temporary Increase of Charges) Act, 1918, authorising them to increase their fares beyond their statutory limit. Negotiations and interviews with the authorities concerned continued throughout the year, the results of which only became apparent in 1920, when the Tramways (Temporary Increase of Charges) Bill became law. I have now covered most of the statutory and other matters with which we are concerned, and if there are any members who desire to ask questions I will do my best to answer them.

Mr. A. L. C. Fell formally seconded the motion, which was then carried unanimously.

The Chairman explained that the next business was the election of seven new members on the Council in the place of those retiring, in addition to Sir Arthur Stanley, viz., himself, Messrs. Tegetmeier, Goodyer, Hardy, Thom, and Baker. The Council recommended the election of Mr. C. G. Tegetmeier (for a second term), Mr. A. W. Chivers and Mr. P. M. Rossdale (all three gentlemen representing the British Electrical Federation), Mr. J. Ford (general manager, Isle of Thanet), Mr. W. G. Verdon Smith (managing director, Bristol Tramways), Mr. J. C. Whiteley (general manager, South Shields Corporation Tramways), and it was proposed to leave one vacancy. They were all very much indebted to the retiring members of the Council for the work which they had done.

The vacancy was suggested because the Council were rather anxious to have a representative of a foreign undertaking among them. There were a good many foreign and colonial tramways, and the Council would like an active member who would be able to keep them in touch with undertakings outside the British Isles. He moved the adoption of the recommendation of the Council.

Mr. C. J. Spencer (London) formally seconded, and the motion was accepted unanimously.

Alderman R. A. Smithson (Leeds) moved the re-election of Mr. A. W. Chambers, the honorary auditor, and that the thanks of the Association be tendered to him for placing his valuable time at the disposal of the Association.

This was formally seconded and agreed to.

Mr. A. L. C. Fell (London) said that before the business meeting closed he desired to propose that the best thanks of the members be tendered to the Vice-chairman of the Council, Mr. R. J. Howley, who during the past three years had been solely in charge of the Association in the unavoidable absence of the chairman, Sir Arthur Stanley, on war work. Mr. Howley had done magnificently, and had not only conducted the affairs of the Association to their entire satisfaction, but he had also been a very prominent member of the Board of Trade Tramways' Committee, on which he did invaluable work on behalf of the tramways industry. He was sure that if they could only retain Mr. Howley in his place he would do still more valuable work for them in the future. He moved a most cordial vote of thanks to the vice-chairman. (Applause.)

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Mr. E. H. Edwardes (Lancashire United Tramways Company), in seconding the motion, said that as a member of the Council for the last two years, he could say that he did not think Mr. Howley had missed a single meeting. The amount of work he put in, as Mr. Fell had said, was quite extraordinary.

The motion was carried by acclamation.

The Chairman thanked the members for their appreciation. It was true that during the three years he had occupied the position of vice-chairman they had had some troublesome matters to deal with. During the war, before the Whitley Councils took on the work, the Association had to carry on negotiations on behalf of their members with regard to fixing wages. He confessed to feeling somewhat "lonesome" that day, as that would be his last appearance in connection with the Council. He hoped, however, still to be able to help in connection with one or two technical committees, and they might be quite sure that even when he was not directly representing the Council of the Association as vice-chairman, he would in his personal capacity always do everything he could to forward the good work which was being done by the Association and to advance the interests of the members. He thanked Mr. Fell and Mr. Edwardes for their kind words, and he hoped that the Association would go forward in the future as it had in the past, and that its work would continue to be a benefit to their great industry as a whole. (Applause.)

The proceedings of the business meeting were then concluded, and the annual congress followed. Mr. R. J. Howley presided, and the members present represented numerous tramway companies with undertakings in various parts of the country.

The first paper was presented by **Mr. C. J. Spencer,** who remarked that he was in America about six weeks and had come back with full knowledge of American conditions. Perhaps, like many other people who had spent a short time over there, he knew far more about the conditions than Americans themselves.

SOME NOTES ON TRANSPORTATION IN AMERICA.

BY C. J. SPENCER, O.B.E.

(Manager, Metropolitan Electric, London United, and South Metropolitan Tramways Companies.)

After many years' experience of tramway work I frequently review the experiences of the past and attempt to assess the value of the various policies of management which have been followed from time to time by myself and others connected with the industry. I have no hesitation in saying that the most valuable policy which has ever been pursued has been that of "finding out what the other man is doing."

The two tramway associations in this country have provided opportunities which have been of inestimable value to the industry as a whole, by their meetings and discussions, and I here desire to lay stress on the importance of these meetings, and, in particular, the unofficial meetings of the members of these associations, where men engaged in the same industry compare notes of their experience and interchange ideas and views regarding a business devoid of trade secrets.

It is possible that, due to our insularity, we have been too much satisfied in the past with comparing our experience almost entirely with that of men of our own nationality in our own country, forgetting that men in other countries are dealing with similar problems, and that in all probability we should gain considerably by a close examination of the methods adopted by other operators in another part of the world, and at the same time do no harm to those from whom inquiries are made. More than that, we should be establishing a fellowship of transport men of international scope. We, of course, have access to the foreign journals, and our excellent technical Press is not unknown abroad; but for real beneficial interchange of experience there is nothing to equal the quiet, informal chat, the look round the job, and the establishment of an *entente* between transport men wherever they may be.

That, at any rate, was the view held by my chief, Lord Ashfield, when I, along with three colleagues from the Underground Company, were instructed in the autumn of 1919 to visit the United States of America, and there meet responsible managers of transportation undertakings—discuss with them transport problems, examine their undertakings, and come back, if possible, with a wider knowledge of the very important problems with which we are all faced, and which are calling for urgent solution. The visit to the United States from the point of view that I have mentioned was an unqualified success. American tramway men were more than courteous and polite; they were friendly and seemed only too glad to have a chance to compare notes with an English tramway man. I should like to take this public opportunity of expressing my personal gratitude to them all for their kindly welcome and help. Nothing was withheld; we were made to feel at home, and told that if we came away without all the knowledge we sought it would be entirely our own fault.

FINANCIAL POSITION OF UNDERTAKINGS.

We there met men who, like ourselves, were greatly concerned as to the somewhat unfortunate financial state of their undertakings, and who were, with characteristic American energy, facing this problem to the best of their ability. It is altogether unnecessary for me to go at length into any detailed explanation of operating methods in the States as compared with this country before an assemblage such as this, as I am sure you are all in touch with American literature, and are aware of the conditions under which our colleagues are working over there. It may, however, be of value to look at these conditions through the eyes of an English tramway man to see what we may learn thereby.

As in England, the main problem facing the tramway (street railways) companies of America to-day is the financial problem. As a result of the war costs have risen in the neighbourhood of 100 per cent., whereas revenue has, generally speaking, not advanced more than 8 per cent. or 10 per cent. Broadly, this is being met in the only two possible ways, viz., the increasing of revenue, mainly by increasing fare charges, and the introduction of improved methods of operation to keep a check on increasing expenditure. This has rendered necessary a complete overhaul of fare charge systems and methods of collection.

FLAT FARE *v.* ZONE SYSTEM.

The flat 5 cent fare system has certainly cramped the economical development of some undertakings. Whilst the simplicity and ease of collection of a flat universal fare is very attractive, and, on a system of reasonable dimensions, an economical arrangement, yet it is a system which has limitations. The natural inclination in big cities is for the city worker to live well out of the centre and become a long-distance rider, so that the tendency is for the distance of travel per passenger to steadily increase, and, as this traffic must perforce be catered for, expenses are likely to increase faster than revenue. There is, therefore, a very acute controversy on the question of zone versus flat fare systems of payment.

Our American friends, however, have realised, as we have, that it is no easy matter to alter the habits of a population, and there is no doubt that in the States the 5 cent flat fare has become exceedingly popular, and any change which means primarily an increase of payment by the passenger and a departure from the simplicity of the flat payment system has been in many cases very strenuously opposed. There is also opposition from the management to the introduction of complicated methods, such as the ticket system as we know it in England.

I was therefore very interested in a new zone fare collection system recently introduced on the Connecticut Company's lines in New England. This company operate several fairly large systems in the thriving towns of the State with inter-urban connections. They have now established zones one mile in length, starting from traffic centres, on the basis of a 6 cent initial cash fare for two zones or less, with a charge of 3 cents for each additional zone. Tickets can be purchased in quantities of 50, entitling the passenger to ride a mile for 2 cents.

According to my latest information this basis of charge is working out satisfactorily, both to the public and the company, and is showing distinct signs of retrieving the financial position of the company.

It is interesting to translate their rates into English coinage and compare the charges to the public with the British practice. Taking the exchange value of a cent as ½d., and turning the American (New England) position into British parlance, it is clear that the initial fare is 3d., with a rate of 1½d. a mile.

OPERATING COSTS.

When it is remembered that the cost of operating a tramway undertaking in this country is, at least, as high as the cost of operating an average undertaking in the States to-day, a simple question immediately arises—Why is it necessary to charge the American public a higher rate of fare for tramway transportation than anyone has dared to suggest will be necessary in this country?

A satisfactory reply to this is by no means easy, and a study of the economics of the situation becomes advisable. I may be quite wrong, but, so far as I am able to see, the riding habit, at any rate with short-haul traffic, is not so great on the average American system as in this country.

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In the table attached hereto I have attempted to make comparisons of operating results between typical systems in this country in the suburban metropolitan area and two typical systems in the States. The English systems, A and B, are, of course, zone systems, operating 70-passenger double-deck cars and charging at the rate of approximately a penny per car mile for ordinary passengers and approximately a halfpenny a mile rate for workmen. The American systems, C and D, are of much greater dimensions, one having a zone fare collection scheme and the other a flat fare.

It will be noted that the average number of passengers carried per car mile on the English systems is in excess of the American systems—that the receipts per car mile and the cost of operation universal in America, and that what experiments have been conducted in that country with double-deck cars have not been successful.

I believe that time spent in the consideration of the most suitable vehicle for the future, that is, single-deck or double-deck, would be well spent, and, personally, I would welcome any information from English operators on the advantages and disadvantages of each type.

On the question of average speed I did not find that our friends in the States are doing much better than we are doing, and yet it appears to me that one great hope of reducing working costs is in the direction of a greatly improved average speed of travel.

COMPARATIVE OPERATING STATISTICS OF TWO ENGLISH ("A" AND "B") AND TWO AMERICAN ("C" AND "D") SYSTEMS FOR THE YEAR ENDED DECEMBER 31, 1919.

	"A"		"B"		"C"		"D"	
	Amount. £	p.c.m. d.	Amount. £	p.c.m. d.	Amount. £	p.c.m. d.	Amount. £	p.c.m. d.
OPERATING REVENUE—Total	795,644	18·69	489,156	17·89	2,146,005	18·04	3,192,584	20·04
OPERATING EXPENSES—								
TRAFFIC—								
Superintendence	2,826	0·07	2,430	·09	40,430	·34	49,032	·31
Wages, Motormen and Conductors	188,284	4·42	137,676	5·03	613,338	5·16	888,813	5·58
Other Traffic Expenses	77,408	1·82	50,477	1·85	109,629	·92	118,343	·74
Total Traffic	268,518	6·31	190,583	6·97	763,397	6·42	1,056,188	6·63
GENERAL—								
Salaries, Officers and Staff	13,040	·30	9,572	·35	58,126	·49	47,855	·30
Rates and Taxes	10,731	·25	6,699	·24	129,095	1·08	261,383	1·64
Accident Insurance and Compensation	13,929	·33	9,939	·36	70,491	·59	208,718	1·31
Printing and Stationery	2,466	·06	2,040	·07	13,781	·12	13,265	·08
Other General Expenses	17,215	·40	14,522	·54	59,790	·50	71,132	·45
Total General	57,381	1·34	42,772	1·56	331,283	2·78	602,353	3·78
REPAIRS AND MAINTENANCE—								
Permanent Way	75,781	1·78	45,522	1·66	182,118	1·53	276,978	1·74
Electrical Equipment of Line	10,999	·26	9,455	·34	46,512	·39	22,974	·14
Buildings and Fixtures	4,374	·10	5,526	·20	6,892	·06	11,255	·07
Cars	126,933	2·99	106,656	3·90	161,856	1·36	257,450	1·62
Other Repairs and Maintenance Expenses	6,402	·14	7,998	·30	70,152	·59	56,924	·36
Total Repairs and Maintenance	224,489	5·27	175,157	6·40	467,530	3·93	625,581	3·93
POWER—Total Power	98 182	2·31	74,233	2·71	410,490	3·45	248,718	1·56
TOTAL OPERATING EXPENSES	£648,570	15·23d.	£482,745	17·64d.	£1,972,700	16·58d.	£2,532,840	15·90d.
NET OPERATING REVENUE	£147,074	3·46d.	£6,411	·25d.	£173,305	1·46d.	£659,744	4·14d.
Operating Ratio	81 per cent.		99 per cent.		91·4 per cent.		79·3 per cent.	
Car Mileage	10,219,168		6,565,979		28,539,155		38,234,436	
Passengers carried	125,805,992		70,628,244		240,000,000		402,808,820	
Passengers carried per Car-mile	12·31		10·76		8·44		10·53	
Average Fare paid per Passenger	1·52d.		1·66d.		2·14d.		1·90d.	
Route Miles	56·25		53·5		504·74		393·68	

are approximately the same, and therefore the only difference appears to be in the number of passengers carried per car mile. Of course, the hypothetical tramway passenger is to some extent an elusive factor, and any deductions drawn from the number of passengers carried must be very carefully considered before being accepted, and I don't wish unduly to press the point.

DOUBLE-DECK *v.* SINGLE-DECK CARS.

It may be that the almost universal use of the double-deck cars over here provides some explanation, or perhaps the low initial rate of fare may be the cause of the larger short-haul traffic. It would be interesting to have the views of the members of the association on the earning value expressed in pence per car mile of a single-deck compared with a double-deck vehicle.

I know that there are systems in this country running almost entirely single-deck cars, and that we are sometimes told that we in this country have made a mistake in adopting a double-deck car. At any rate, it is strange that the single-deck type is almost

FEATURES OF ROLLING STOCK—ENGLISH AND AMERICAN PRACTICE.

A feature that appealed to me was the considerable progress that has been made in the design of rolling stock as compared to this country. The car which most of us are using to-day bears a remarkable resemblance to its prototype, the horse car. The driver still stands behind a steel dash, and in his dreamy moments appears to see a pair of horses in front, and, apart from the use of the magnetic brake, which has *some* advantages, he still retards the speed of his car by the strength of his right arm. We still believe in the strict isolation of the driver from the passengers, and waste a great deal of space on a platform that is only used occasionally. In fact, the electric car as we know it to-day is not very much changed from the electric car of twenty years ago.

This is not the case in America. I was there sixteen or seventeen years ago, and, apart from what I saw in a tramcar graveyard—a very useful institution—I did not see very many cars of the type in use then. The new type of car is essentially an electrically-

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propelled high-speed vehicle, as contrasted with a glorified horse-drawn carriage; the driver is covered in; the cars are universally equipped with power brakes; the partitions between the driver and the passengers and the passengers and the conductor have disappeared, and the whole floor space is utilised, with the result that both the driver and the conductor are doing their work under much more comfortable conditions than tramway employees in this country.

The payment of the fare by the passenger before he takes his seat is almost universal, with the exception I will shortly describe. The days of the conductor struggling through a crowded car to collect his fares is a thing of the past. The cash is dropped, under the eye of the conductor, into a fare box (a sample of which is lying on the table), which automatically registers and counts the cash paid. So far as fare collection is concerned the duties of the conductor are simple. His primary duty is to see that every passenger places his or her proper fare in the box.

With the introduction of automatic doors at the entrance to the car the responsibilities of a conductor and the dangers to passengers in alighting and boarding have been reduced to a minimum. The conductor, either by means of a pneumatic button or mechanical lever, controls the opening and shutting of the doors. The doors cannot be opened whilst the car is in motion, except in cases of emergency, and the car cannot be moved whilst the door is open.

The effect of this innovation is interesting. The necessity for a signal between the conductor and the driver for starting the car has gone. A passenger or a conductor may signal the driver to stop, and when the car has stopped the door is opened by the conductor and the passenger alights or boards, as the case may be. The driver does not wait for a signal from the conductor to restart his car; as a matter of fact, he places his controller pointer on the first starting notch and waits until the car starts, which is when the conductor closes the door, and this door cannot be closed until the passenger is in a safe position. I was informed that this had had the effect of practically eliminating alighting and boarding accidents on American systems, and this I can well believe.

This arrangement, together with the fare-box system of collection, which in turn is related to the "pay as you enter" system, has effected a very great improvement in the operation of cars, and the average speed of travel has not decreased in consequence.

"PAY AS YOU LEAVE."

The very latest system, however, in the States to-day is not "pay as you enter," but "pay as you leave," and this appears to be working with considerable success on the Connecticut system with its zone fare collection methods. The passenger boards the car at the driver's end and receives from him a slip of thin paper upon which is printed the zone in which the car stands at the moment the passenger enters. This is done very quickly by the use of an ingenious clip and packet of tickets. The passenger, after receiving his slip, takes his seat, and when he gets near his destination moves towards the rear of the car, informs the conductor that he desires to alight at the next stopping place, and hands him his slip, from which the conductor computes his fare, aided by a simple scale posted up in the car. (The scheme bears some resemblance to the system of paying for a cup of tea in a London restaurant.) By the time this transaction is finished the car has probably arrived at the stopping place, the door is opened by the conductor, and the passenger leaves.

The obvious criticism of this system is that some delay might take place when a number of passengers desire to leave at the same point and have their fares to pay before leaving. I am bound to say that, having seen the system in operation as an ordinary passenger, I, personally, did not see any delay. In every case the transactions were completed so quickly that before the car came to a stand the passengers were gathered round the door ready for leaving, though I would not say that with the introduction of a new system delays might not inevitably occur until the public became accustomed to the new arrangement.

ONE-MAN SAFETY CAR.

This is the latest development of rolling-stock design in the States. As probably everyone in this room is aware, the one-man car was originally invented by the late Mr. Raworth, and I believe is still in use in some towns in this country, but for some reason or other it has never made much progress. I found, however, in the States that some car-building firms have designed most ingenious cars carrying from 30-40 passengers, and are supplying them in large quantities not only for small light traffic systems, but even for fairly heavy traffic routes. The Brooklyn Rapid Transit Company intend putting 200 of these on to their routes to deal with slack-hour traffic.

These cars are very lightly built, well sprung to give smooth riding, are quickly accelerated from rest to full speed, and as quickly brought to a stand by means of the air-brake. The cost of operation is about half that of an ordinary heavy car, and they certainly appear to meet all the requirements of normal traffic.

My friend, Mr. Pringle, who I believe follows me with a paper on Australian practice, will, I am sure, tell us a great deal of interest about the one-man car as he knows it. One thing is certain: wages of tramway employees have now got to such a high figure that it is up to the management to economise to the utmost with labour. In the States the one-man car is universally popular—popular with the management, with the public, and, I was pleased to find, also popular with the men who operate them. It is an efficient labour-saving device, and as such has been accepted by the men. I hope that our employees and their leaders will see that their ultimate interests are best served in this country by accepting inventions which economise rather than waste their efforts.

I generally found that the effect of the introduction of one-man cars was to nearly double the headways, the result being that far more cars and miles were run than had been run previously, so that ultimately it was not a question of dispensing with men, but giving the public a better service and the company an improved result and incidentally putting the petrol competitor—the jitney car—out of business.

The essence of success, however, for one-man cars was a simple fare collection system. I believe that in this country we shall have to overhaul our somewhat complicated and troublesome bell-punch and ticket system, and see whether we cannot evolve some more simple method of checking our revenue.

COUPLED CARS AND PEAK LOAD.

As in this country the peak load is a great problem. Large coupled cars, with a conductor to each car but only one driver for the train of two and sometimes three cars, is fairly common practice. It will be seen that the great tendency is labour saving, and railway, rather than evolved horse-car practice, is being developed. Automatic couplers of ingenious design are in use, whereby all power circuits and brake connections are automatically made when the coupling takes place.

SCHEDULES.

I found that on most of the systems in the States which I had the pleasure of visiting, great attention, of a scientific character, was given to the designing of working schedules. The same human reluctance to long spreadover of duties was shown by the trades unions catering for tramwaymen in America as is shown here, and therefore the designer of a schedule had to bear in mind that he was dealing with men and not mechanical units.

On most systems a traffic research department of considerable dimensions was deemed an essential part of the organisation, and the development and fluctuations of traffic were very carefully adjusted and schedule alterations made to meet the changed conditions, with the result that greater efficiency of working was being accomplished.

The old system of turning out a certain number of cars in the morning and letting them run all day, on the principle that it was a good average service to meet average conditions, had vanished. The headway must be designed to meet the traffic conditions throughout each period of the working day, and to do that without incurring unreasonable hours of duty for employees is the problem of the schedule maker, and on some systems this has been reduced to a science. The schedule maker is a man who can save his tens of thousands or equally well waste them, and I can commend the study of this subject to anyone who is in control of a tramway undertaking.

LABOUR CONDITIONS.

Operators in this country have generally accepted the statement without question that labour in the United States was very much better paid than labour in this country, and was therefore much more expensive. This was undoubtedly true in pre-war days, but, in my view, it is no longer so. A tramcar driver or conductor receives to-day from 44 to 50 cents an hour, that is, 1s. 10d. to 2s. 1d. per hour. This figure is not high compared with what we are to-day paying in straight wages, but, when all is taken into consideration, I believe we are now paying higher wages.

Common practice in the States is for a straight hourly payment to the men when actually on their cars in service. There are no signing "on" and "off" allowances; there is no payment for uniforms; these must be provided by the men to the company's requirements; and there are no free holidays, so that on balance I do not believe that an American tramway employee is any better paid, if as well, as his colleague in this country.

This, I realise, is an important statement, especially when considered in the light of what I have stated regarding fare charges to the public. I believe there is grave reason to fear that our labour costs in this country are in danger of overstepping economic possibilities, and if that is so the employees themselves will be the first to feel the bad effects, unless, of course, the questionable policy of someone, other than the passengers, helping to pay running costs becomes an accepted policy. On the other hand, comparatively high rates are paid to skilled artisans, but they only represent

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a small percentage of the total wage bill of any undertakings, as we all well know.

Relations between the trade unions and the undertakings appear to be much the same as in England, and the same kind of controversies are taking place. In Philadelphia we found a "co-operative" system in operation bearing a strong resemblance to our Whitley Council arrangement in this country, and which we were told was giving good results.

MAINTENANCE AND LABOUR-SAVING DEVICES.

I had the advantage of inspecting many details concerned with maintenance, and, whilst I have no doubt you would find much to interest you, it is impossible to do other than deal with generalities in this paper. For example, I found that a common arrangement was the employment of an economy officer, whose sole duty is to study every phase of working with one single object in view, viz., "economy of operation."

The utmost use of labour-saving machinery is made in every department, and this is particularly true in connection with the maintenance and construction of permanent way, where most ingenious machines are in use for tearing up the roadway, digging out the trench, mixing concrete, etc., etc., with the result that the labour cost of permanent way reconstruction in the States is less than in this country at the present time. The present high cost of labour in all departments is very properly driving employers to consider the use of machinery wherever possible. When it is considered that the wages paid to an ordinary labourer to-day when capitalised represents a sum of approximately £2,000, this is not surprising.

GENERAL.

Generally, I came back impressed with the idea that there is room for considerable improvements in our methods in this country. On the other hand, I did not see very many indications of fundamental changes in tramway evolution and operation. I believe much remains to be done to improve the electric tramcar. We are all concerned with the excellent development of the internal combustion engine type of street passenger-carrying vehicle, and we cannot be blind to the possibilities of the future. It must be remembered that we have very considerable advantages in possessing a steel rail and the consequently large carrying capacity unit, in addition to an almost unlimited supply of power per vehicle and the unrivalled qualities of an electric motor for traction work. Much can be done to meet the development of the motor omnibus, but we must get down to fundamental design and scrap the idea of fixing trolleys, motors, and controllers to horse cars. I found our colleagues in the States very much alive to the necessity of progress in design, but most of the technical details did not differ materially from our own.

We have in this country generally been first in really new ideas. I am sure that in the tramway world we should endeavour to regain our lead, and I hope the time is not too remote when our American friends are coming here to see the latest in transport practice.

The Chairman said he was sure all the members would join with him in thanking Mr. Spencer for his very interesting and instructive paper. It was perfectly true, as pointed out in the opening, that to every tramwayman there were sources of new ideas in what was being done in other countries, and he hoped that other members of the Association who wandered about the world would at subsequent conferences give the members the benefit of their experiences and views as Mr. Spencer had done. (Applause.)

Mr. Spencer, in acknowledgment of a vote of thanks for his paper, said that he had only touched on what their American friends would call the "high lights" of the matter. It was quite impossible to discuss in detail all the interesting things he saw over there. He hoped they would have a good discussion, and welcomed criticism of the most searching kind.

DISCUSSION.

Mr. W. T. Robson (late general manager Southampton Corporation Tramways) said no one in that room had listened with greater pleasure to the paper than he had. It was an excellent paper. At the time Mr. Spencer was over there he also was in America, but he did not succeed in catching him up. They seemed to be chasing each other all over the country, and being a free lance, perhaps he (the speaker) was able to cover more ground and dig more closely into one or two matters than Mr. Spencer had been able to do in his official capacity. So he would tell them one or two things which he had discovered and which Mr. Spencer had been unable to reach. It was quite true, as the paper stated, that the short-distance rider had not been cultivated in America as in England, and he had one or two theories as to why that class of passenger had never come to the front in America. One reason was that the managers of American systems made it so very difficult for people to get on the cars. In Manchester the other day he boarded twelve cars in motion in the course of one hour. That was a thing which could not possibly be done in American cities Approaching a car, one thought the rear door was going to open, but it was the centre door that opened, but if you went to the centre door then it would be the front and rear doors which would be open. One never knew which door would be available so one could not jump on a car as one could do in England. He was sure that in America every system lost thousands of pounds annually through that very reason alone—that it was not possible to jump on a car when it was going. After all, looking at the tremendous number of passengers they got in England through the open platform habit, he would not give it up for anything from a revenue point of view. Certainly the American system tended to prevent accidents, but in view of the very high accident expenses in America they could wipe that consideration out absolutely. That brought him to the next point, i.e., the cost of accidents to American tramway undertakings. He found out that in the States anybody who wanted to make a bit of money had only got to stand in front of a car and get hit, and then go to a hedge lawyer, a man who made accidents his business, who knew tramcar and railway work, and had special qualifications for appealing to the sympathies of a jury. That was the reason people met with accidents there, for it resulted in their getting one or two hundred pounds damages without any trouble, and that was the reason why the American accident expenses were so high. They were high undoubtedly, perhaps five times as high as in this country and cost five times as much per annum, although they had no platform accidents and they ought not to have any other kind of accidents, for the air-brakes pulled up the car in very much less time than the English hand-brake. Another reason discouraging the short-distance passenger was the absence of facilities for smoking. A great many men in America were cigar smokers, and it often became a question when a man had to go a quarter or half a mile whether he would throw away the cigar or walk. If he were smoking a good cigar under similar circumstances, he knew what he would do, viz., walk and save cigar and fare. It might seem silly, but it was perfectly true; he knew of many cases, and smokers all over the world, and particularly in America, would walk owing to the fact that every time they got on to a public vehicle they had to put their pipes out, just as they had to do when they went into any other public place, like a theatre. Then another reason was the absence of open-air riding. In America there was no such thing as open tops. Here we dropped the windows in summer and put them up in the winter time, and this was certainly an inducement to short-distance riders.

He had covered a good deal of ground in America, and went to see some of the smaller systems in outlying places. He went as far south as Florida, and found the tramway systems there were in a much worse condition than any English ones. The latter were the equivalent of tramway systems round about New York, where they did see some good systems. He was very much impressed by the scientific management which Mr. Spencer had referred to. He had met several men on different systems whose sole job was to see how the management could cut down expenses or increase receipts. He believed that there was a big field for work of that kind in this country. It was a job in itself, and one had no proper idea of the scope for development in that particular line of specialising.

On the question of the wages comparison, he did not know whether Mr. Spencer went to Chicago or not. (**Mr. Spencer:** No.) **Mr. Robson** said in Chicago wages were then 60 cents. per hour No doubt it was a good deal more now, so that on that basis the costs were higher than they are here. Generally speaking, what impressed him on the American tramway systems was the simplicity of fare collection. There was an almost entire absence of missed fares through their mechanical boxes, and this combined with quick loading and unloading. At Cleveland he was impressed with the combination of the pay-as-you-enter and pay-as-you-leave systems.

He thought the air-brake a wonderful thing. He did not know whether we could introduce it here. On every car in America the bells were operated from the trolley lines, so that the signals never failed and there was no occasion for the conductor to tap the window with a punch because the bells were out of order. There was improved machinery both in type and principle. On track work, he saw at Detroit a machine like a big plough for pulling up setts. No doubt that saved a lot of time, and there were grinding machines, sweeping machines, and everywhere they had studied the economy of efficient machinery. He was exceedingly glad to have had that opportunity of listening to Mr. Spencer, and was only sorry he did not succeed in catching him in the States.

Mr. W. Vincent Edwards (engineer and general manager Hastings and District Tramways Company, Limited), referring to Mr. Spencer's remarks on the internal combustion engine, said that he thought their system at Hastings was the only one on which it was used in this country. Their difficulties would, however, soon be over because they hoped to be rid of them in a few months. The internal combustion engine was strictly limited in its power. A tramcar

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fitted with a 50 or 60 H.P. engine was at a great disadvantage compared with the ordinary tramcar which could develop 250 H.P. simply by opening the controller. They found that was the vital defect. He would like to know whether Mr. Spencer recommended the internal combustion engine or suggested that it was possible or desirable to adopt it here.

Mr. H. P. Stokes (engineer and general manager Plymouth Corporation Tramways) said that he would be glad to have a little further information with regard to the traffic research department. Mr. Spencer stated that the fluctuations of traffic were adjusted from day to day. But in this country we had a guaranteed working day of not less than seven hours and not exceeding nine hours, an average eight-hour working day. He would like to have some information as to how that traffic research department could satisfy the requirements of the men in altering their duties from day to day to meet the different conditions prevailing.

Mr. P. J. Pringle, M.I.E.E., M.I.Mech.E. (general manager and chief engineer, the Electric Supply Company of Victoria, Limited, Ballarat and Bendigo, Victoria, and a past member of the Council of the Association) observed that there was very much in Mr. Spencer's paper which was of great interest to them all and well worthy of consideration. His references to the type of car were specially valuable. It was surprising to find this country of ours so conservative in its devotion to the double-deck car. In Victoria they had a hot climate where it was necessary, of course, to make provision for smokers, and it was found possible with a single-deck car to give all the facilities that were required. He thought the question of the weight of the cars in future would have to receive far more attention than in the past. These light one-man cars of 6 or 7 tons were important, because he thought that the use of such cars would reduce the maintenance bill, and he had been struck by an examination made recently of the reduced wear and tear where light cars were used. This would also affect economies in the future cost of replacing the rails.

As to the question of signing-off time, in Australia they had done away with signing-off time by turning out the cars in the morning only after certain experienced officers had examined the car brakes and were assured that everything was in order. If they could save signing off time, which very often represented half an hour, or about 7 per cent. of time, they were going to get a 7 per cent. reduction in their wages bill per car.

He would also mention a way to reduce some of the present platform expenses. In regard to the pay-as-you-leave system, he would like to ask Mr. Spencer whether he came across any system for pay-as-you-enter on the way to the centre of towns and pay-as-you-leave on the reverse trip. That was the system they adopted on the other side, and he thought it had some advantages on the pure pay-as-you-enter or pay-as-you-leave systems. He would also like to ask Mr. Spencer if he could give any reason for the high cost of superintendence in America as quoted. It appeared to him that with the type of farebox exhibited the cost of inspection should be very materially reduced. One would have expected to see that item less than on this side. He would also like to ask whether the author of the paper was strongly in favour of the air-brake. They were particularly interested in Australia in this subject, because there was a very great demand from the men to have air-brakes on all cars. They, as managers, did not consider that the time had arrived for that yet, and apparently that was to some extent the case in this country. He would like to know whether Mr. Spencer's visit to America had altered his opinion on the matter.

The maintenance cost of cars was very much less on the two systems quoted in the papers than with us. What was the reason for that? The majority of the American cars were from 15 to 20 and 25 tons, and one would naturally expect the cost per car mile to be materially higher. Some information on that point would be very interesting. There was also the question of the rail section used on American lines. Their standard was of a very wide grooved type. That again was a thing to study, and one would like to know if there had been found to be any serious disadvantages. In Australia they had a rail somewhat on those lines, and he would be glad of any information Mr. Spencer could give.

Mr. E. H. Edwardes (general manager, Lancashire United Tramways, Limited) said that he had listened with great interest to Mr. Spencer's instructive paper. It was so full of matter that he found a difficulty to know where to commence in discussing it. He took it that the great majority of the American tramway systems visited were very large systems, perhaps larger than our largest, and it appeared to him that one of the great drawbacks to the English tramway industry was that a very large majority, an enormous majority, of the undertakings are very small, ranging from three to four miles to about 40. The result was that the greatest difficulty was found in providing what one might call luxuries in operation, such as expensive machinery for track repairs, economy officers, professors in schedules, and types of officers like that. It appeared to him that the only way to get over that difficulty would be for professional men to set up in those positions and undertake the job of looking into the working of the various small tramway systems. Doubtless members would agree with him that that was the difficulty they had in England, because they were aware that a large percentage of the tramway undertakings were very small.

He would like a little further explanation as regards the collection of fares. Did he understand that in all systems of pay-as-you-enter or pay-as-you-leave each passenger was supplied with some sort of ticket or some sort of piece of paper? Otherwise it seemed to him that they trusted the passenger and the conductor together to put the fare into the box. There would be no check that the passenger did put it into the box. On his system in the north they sometimes found there was a great league between the passenger and the conductor. The conductor had a lot of pals who rode for nothing or anything. That was their experience in his district, and hence it was necessary to have some ticket inspector who could board a car and see that every passenger had got a ticket.

Then again, of course, there was the great and everlasting question of the top covers to the cars. They all knew it blocked the collecting of fares by pay-as-you-enter or by pay-as-you-leave. Were Englishmen ready to do away with the habit they had had for many years of travelling on the top of a car? What would London people say if they could not ride on the top of an omnibus?

Mr. Spencer—I do not know. (Laughter.)

Mr. Edwardes said he thought they probably would not ride. They had got used to the staircase and they liked to go up and down, especially the ladies. (Laughter.) The London General Omnibus Company had been very carefully considering for some months or even years a new design of omnibus, and he noticed they had still got the old types, with top seats, and it appeared to him that they would lose a great amount of revenue if they did not give the passengers an opportunity of riding on the top of vehicles. He did not think they could alter it for another 100 years, when a new generation might get used to it. The automatic car doors as referred to by Mr. Robson, he confessed he viewed with horror. One of the great difficulties which he thought many car managers had was that drivers would not wait for passengers. They were flooded with complaints, and the only means a passenger had of getting on a car was to jump on when it was moving. He was afraid if they had automatic doors they would not have an opportunity of getting on at all.

Mr. R. G. Cunliffe (Metropolitan-Vickers Electric Company) said that the author had drawn very interesting comparisons between British and American practice, and referred to later forms of American car design and equipment. There was only about 10 per cent. of the latter equipment in this country. In many cases the motors used were from 15 to 20 years of age, and with them it was quite impossible to cope with modern conditions. There was an overloading of the capacity for which they were designed, and yet with these motors the management was expected to maintain the services. On some systems new motors were being purchased and put into operation on routes on which cars with old equipment were used. Until they eliminated the old stock the difficulties would, of course, remain. Modern machines should not be mixed up with the old types, otherwise most of the advantages of the new type were lost. The American tendency is towards the adoption of railway type cars and trucks with electrical equipment designed and constructed for heavy service, whereas the tendency in this country, in so far as the user is concerned, is still towards the consideration of street railway equipments from the point of view of earlier practice. In comparisons made between British and American methods of operation, the outstanding fact which it is important to grasp is that whilst 90 per cent. of American cars are equipped with modern motors and control gear, the reverse is the case in this country, where 90 per cent. of the cars are equipped with motors, etc., long obsolete. The standard American car has ventilated motors each with four interpoles, carefully designed from the point of view of maintenance and operation. This type of motor has been very highly perfected by the leading British manufacturers, and is slowly but increasingly replacing the older types of totally enclosed, non-interpole motor. The low maintenance costs, low temperature characteristics, high weight efficiency, increased continuous rating, and standardised parts render these motors ideal for tramway operation, and there can be no doubt that the economical operation of most British undertakings demands the adoption of such motors and the scrapping of the obsolete machines at present in use. The saving in the costs of repair and maintenance much more than counterbalances the high capital cost of replacement of equipments. Tramway specifications for motors often state only the horse-power rating on a one-hour basis, whereas the continuous rating is the proper criterion, and a comparison of modern with older design shows a 50 per cent. increase in continuous rating for machines of equal one-hour rating. In America the street railway undertakings adopt the bold and successful policy of keeping in touch with the advance of design, and in consequence have at their disposal powerful

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units, efficiently driven, economically run, and under admirable control by the use of power-brakes which are almost universally installed. The reports of the various British tramway undertakings, both municipal and company owned, show that the capitalised value of the maintenance costs for cars alone would in many cases exceed the whole capital cost of the undertaking, whilst an analysis of such costs discloses evidence of the insufficiency of earlier ratings to cope with modern operating conditions.

Mr. A. W. A. Chivers (British Electrical Federation) said that in this country they had given very great consideration to the question of the one-man car. As many people knew, they had had the benefit of the experience of Mr. Raworth, but those cars had not been an unqualified success. Two years ago he had had occasion to look into the question of the American one-man car, and he was bound to say that he had been very greatly impressed with its possibilities for certain operating conditions, so much so that they had ordered two of those cars for one of their companies. But that company was not operating in this country, but in South America, where conditions were somewhat different, and that of course made a very big difference in the whole matter. For certain conditions in this country, especially where there was a universal fare, he thought the merits of the one-man car were well worth consideration. He was quite confident that with certain conditions it was a good investment, but for other conditions he should hesitate very much indeed to recommend its adoption, wholly or in part.

Mr. Spencer asked for some information in regard to the earning power of double-deck cars as compared with single-deck cars. His company happened to have one undertaking on which they were operating both double-deck and single-deck cars, and where there was a universal fare in each case. He would give the conference the comparisons of earnings of the two types of cars. In the case of the double-decked cars, they were operating on a run of 2·54 miles in length, for which the fare was one penny. The seating capacity was inside 22 and outside 32, making a total of 54. On another route, with a length of 2·49 track miles, there being also the same fare of a penny, they operated single-deck cars with a seating capacity of 37. The earnings of these two types of cars was as follows :—In 1918, double-decked cars, 20·34d. per car mile, 20·41d. in 1919 ; the single-deck cars earned in 1918 on the average, 17·73d. per car mile, and in 1919 19·01d., so that the earning capacity of the double-deck car, with a higher seating capacity, was slightly greater, although not very much greater. But in that connection he ought to explain that the question of overcrowding was quite an important one. In the case of the single-deck cars there was no doubt very excessive overcrowding taking place in those two years, much more so than in the case of the double-deck cars.

There was another point. Mr. Spencer said that the new type of car in America was essentially a high-speed car. He thought they would all appreciate the benefits to be derived from high speed, but just before saying that, Mr. Spencer told them that the average speed was not very much different from what it is in this country. Evidently they made more stops or spent more time on stops, and he would like Mr. Spencer to explain why they got a comparatively low average speed with such high-powered cars. He would also like Mr. Spencer to give them the benefit of his opinion as to the merits of the American one-man car for conditions in this country. He could find no expression of opinion in the paper and would very much like to have one from a tramwayman who had seen them in operation on the other side.

The Chairman said the discussion had been most interesting. He would like to add one or two remarks of his own, as he had been in America some eleven years ago. Things must have advanced very considerably since then, because Mr. Spencer appeared to give them to understand that now they got all the money from the passengers. But when he was over there, they used to ring up the fares on a dial, and he remembered one day travelling in New York with a well-known tramwayman and a friend. They were trying to disabuse his mind of the fact that the fares were not properly collected on the system in question by dial ringing. He paid the three fares and the conductor promptly rung up two and put the third into his pocket. (Laughter.) So he had demonstrative evidence that that sort of thing did go on. In this country some years ago, he took an interest in the pay-as-you-enter car, and they had several worked on the Gateshead system. He had found it very efficient except in dealing with the rushes and where a large number of people were leaving a terminus at the same time. They were going to hear some interesting remarks in the next paper in regard to dealing with a rush at one end and the dribbling out over the route as compared with working on an even collection of passengers the whole way along. After some months' experience the practice was to allow the passengers to board the car without collecting the fares, and then the conductor went through and collected the fares and then saw that any passenger who boarded *en route* paid as he went in, and it worked very well. But they had got to keep this in mind. He did not think that it was generally realised that the American car was a good deal wider than ours and their platform area was consequently a great deal bigger. If there was any question of a pay-as-you-enter car, in America they could quite conveniently divide the doorway into partitions. They did not have many partitions now, but in the old days the platforms were divided into two parts. It was not so easy here, with 6 ft. 6 in. and 6 ft. 9 in. widths. In fact, we had not the same facilities in regard to pay-as-you-enter here as they had over there.

As to the saving of accidents by closing the doors before the start, that no doubt was a very good way of reducing what was perhaps the cause of the largest number of accidents, i.e., boarding and alighting accidents, but at the same time it discouraged passenger traffic. He remembered on one occasion running to catch a car when the two doors snapped in his face, nearly taking his nose off. (Laughter.) There was just that about it. He did not think the short-distance passengers over here, people who are accustomed to jump on and jump off, would be at all satisfied to have this closing of doors on the cars. Here there was a great deal more pleasure travel. He supposed it was largely a question of fare. In America there was a high minimum fare, and it was supposable that even Americans thought twice before they paid 5 cents or 2½d. instead of walking. In Glasgow they gave ½d. fares, as in many towns in the past, or a penny fare ; many people would have a pennyworth on their way. He quite agreed with Mr. Spencer that if our tramways here are going to carry the traffic as they really should, they will have to be brought a great deal more up-to-date in regard to rolling stock, and that a great deal more would have to be done in regard to re-motoring cars. We must have bigger cars in order to save labour. This would reduce the labour cost per passenger carried. They had got to make arrangements for reducing the delay at stops, and they had got to have power-brakes so that the average speed of the cars could be increased. The effect of these developments on revenue would be material. It meant a large capital expenditure and a good many statutory obligations and conditions, especially in the case of companies' undertakings which required modification before they could really be treated on their merits. There were many undertakings, as doubtless all the members knew, which were being carried on with purchase hanging over them in a period of, say, about seven years. They could not expect such a tramway undertaking to be carried on successfully and to obtain the new money which was necessary under conditions of that sort. That was one matter to which he thought Parliament would have to give attention at an early date.

Mr. Spencer in reply said that Mr. Robson was in the States at the same time as himself and he was sorry they were not able to meet. That was quite without design on his own part. Mr. Robson evidently did not agree with what appeared to him (the speaker) a good notion, i.e., the use of doors on tramcars. Mr. Robson complained that there were three doors in front of him and he did not know which was going to open. Well, he (Mr. Spencer) only saw two, so possibly Mr. Robson saw them late in the evening. (Laughter.) Speaking quite without experience, he confessed he was very much impressed with the system of doors. Mr. Robson also mentioned the question of accidents ; well, he did not know the reason ; he never tried to find out. Evidently Mr. Robson had found out how to get £100 or £200 in the States. Now they knew how these costs were so high in the States as compared with similar costs here. He thought there was a good deal in Mr. Robson's comments in regard to the absence of smoking facilities. Our American friends did not do things by halves. They went in for prohibition—they were on the way to wipe out smoking—smoking was not allowed on cars, and it was quite right that the tramways were beginning to lose traffic. He did not go to Chicago, and the figures given in the paper referred more to the Eastern Atlantic seaboard undertakings than to those of the Middle West. The apparatus Mr. Robson saw in Detroit was certainly very interesting. Another paper could be given on labour-saving devices in America.

Mr. Edwardes referred to something he had said with regard to petrol cars. If those remarks had been misunderstood he was sorry. It was not a question of the possibility of using petrol on tramcars ; he was referring more to road vehicles, the motor omnibus. He understood that Mr. Ford had developed a wonderful tramcar in America with a petrol engine. Whilst at the moment it did not appear to be a feasible proposition, at any rate they should keep their minds open as to petrol. They did not know what was before them, but they should not forget the advantage they had in the trolley wire. Mr. Stokes wondered how a traffic research department would work under the conditions of a 48-hour agreement. If Mr. Stokes would give him a call at Electric Railway House they would show him they had a traffic research department in connection with tramways. Of course, they were tied to that agreement just as much as any other undertaking in the country, and it might be interesting to see the way they worked matters under the restricted conditions of that agreement.

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Mr. Pringle was shortly going to address the congress, and at the moment he did not think it was necessary to deal with the questions raised in his remarks with regard to safety cars, etc., because there would be an opportunity to speak in the discussion on the paper. But Mr. Pringle did ask one question which might be answered right off, as to why the cost of superintendence in America was so high as compared with the cost in this country. Well, he did not know; after all, these accounts were not easy to compare, and there might be something in that. But he did know this, and he believed that everybody present would be in sympathy with the Americans in the matter, i.e., that they believed in paying very highly for superintendence. Americans paid very large salaries indeed, and they considered that was the best economy. (Hear, hear.) He thought they would all say hear, hear to that. As to air-brakes, he was asked if his opinion had altered; well, he knew of only one better brake than the air-brake, but he would not say what it was. With regard to car maintenance, possibly the two undertakings he had in mind were peculiarly situated, and the costs of car maintenance were temporarily high. But Mr. Cunliffe supplied the answer. Practically in this country we had followed the policy of keeping old and obsolete plant going long after it was dead. It should be scrapped. America was putting in new plant all the time and was able to keep down maintenance costs better than we could. He thought that English management had made a very great mistake in the past in not scrapping. His largest "thrill" was in the "tramcar graveyard"—a very good institution; they had such a graveyard in New York, piled up with obsolete stuff, and they were very proud of it. If in this country we would see just a little further and scrap material instead of patching and repairing, we should in the long run be better off. Mr. Edwardes, representing the South Lancashire system, said he did not see how small undertakings could possibly pay for some of these things, but admitted that some of the large systems could. It was, of course, true that most of the systems he saw in the States were large systems, and he was comparing them with fairly large systems here. He went on his visit from purely selfish motives. In America there was quite a big business for traffic experts, who were called in by small undertakings to advise them on various points. He believed they made a very good living in that way, and he did not think the undertakings which they advised had any reason to object to their moderate fees. He quite agreed with Mr. Cunliffe. Mr. Chivers said some very interesting things about the safety car. He pricked up his ears when he heard that two had been ordered, but he was terribly disappointed to find they were for South America. He wanted somebody to try these safety cars, and wanted some of his friends to try them first, if possible, and he was sorry Mr. Chivers had not got some here. The examples given of the double-deck and single-deck cars was a very good one and would be of considerable interest to himself and to others. It really was well worth to study closely this question of single versus double-deck car. They were able to run closer services with single-deck cars than with double-deck cars, and they ought generally to consider the whole question with an open mind. He had said in his paper that the American car was essentially an electrically-driven high-speed car, and that was so because in many cases these cars ran between towns at a very high speed. The speed in cities was no higher than our own. But what he wanted to convey, and he was afraid he had done it very badly, was this—that we continued to try to evolve the horsecar while the Americans try to adapt the railway car to street traffic, and there was an essential difference between the two points of view. In England we still stuck to the idea that a tramcar was a hackney carriage plying for hire in the street; the Americans said it was a railway car, and so it is and ought to be. The chairman gave his experiences about ten years ago, and in 1903 he (the speaker) was in America, and could endorse all that had fallen from the chair. There had been an enormous development since those days. It was a strange thing that the old one-man car had not been a success in this country, and he suggested that it was probably due to our conservatism. Really, we did take badly to new ideas, no matter what they were, even the most progressive of us. We saw something new, we tried it; if it was not at once satisfactory, we scrapped it and got it out of the way. On the other hand, the American stuck to it. If he did not get satisfactory results at first he stuck to it for a while. We did not stick to these new things, but let somebody else get them, and then we brought them back in a developed form many years later. He wished Englishmen could get away from that—have more courage and stability—and when they got a new idea stick to it, get through with it, and have something on the streets worth having. We are too much frightened because the first experiment was not quite a success. He did not think there was anything more he could usefully say, and apologised for having kept them so long. Certainly it was all a matter of capital, and he knew the industry was very badly handicapped by legislation; but let them bear in mind that the capitalised value of a labourer to-day was about £2,000, as stated in the paper.

ONE-MAN CARS, RAIL SECTIONS, CORRUGATIONS, DIFFERENTIAL WAGES, & DEPRECIATION ALLOWANCES, FROM AUSTRALIAN EXPERIENCE.

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ONE-MAN CARS.

REASONS WHY ADOPTION SHOULD BE CONSIDERED.

With the enormous increase in tramway operating expenses the financial future of nearly all tramways has reached a very critical stage. The old days, when a revenue of 10d. to 11d. per car-mile justified an increase in the car mileage, with working expenses of 6d. to 7d. per car-mile, have gone, and probably will never return. The new position can be met in three ways—(1) By raising the fares; (2) by putting the loss on to the ratepayers or shareholders, as the case may be; and (3) by further economies in the cost of operating.

Tramway fares are not an absolutely necessary commodity, and many undertakings are finding out that an increase in fares does not result in the anticipated increased revenue. The passing on of increased costs by putting up prices is adopting a line of least resistance, and is bad for the community as a whole. Such a procedure should be the last resource, after exhausting everything that will lead to greater economy and efficiency. Public utilities have done much to prove what can be done in these directions.

The introduction of one-man cars would seem to be an important solution of (3) in the case of many undertakings, and it is somewhat surprising that no undertaking here has, I believe, adopted this principle.

PROGRESS OF ONE-MAN CAR OPERATION.

We have many important examples of the successful operation of one-man cars in America. There are, I believe, over 1,000 cars of the Birney safety type operating in about 100 different undertakings. My company, who operate the electric light, power, and tramway undertakings of Ballarat and Bendigo, Victoria, introduced one-man cars in May, 1913, on 8½ routes out of 11. Two other tramways in Australia and several in New Zealand have one-man car operation seriously under consideration. I am aware that the reasons for the great advance in one-man car operation in the United States cannot altogether apply here. In America the light one-man car, with its lower operating costs, making it possible to give a more frequent service, has replaced heavy cars up to 25 tons; also the flat-rate fare in force in the majority of undertakings has assisted in their introduction. The one-man car has therefore in many cases been able to effect a saving of nearly 50 per cent. in the operating costs, but we cannot look for that here. We can, however, effect a saving of nearly 50 per cent. in our platform costs, which is sufficient to have a very important effect on the financial position.

BALLARAT AND BENDIGO ONE-MAN CAR OPERATION.

Owing to certain wage awards in 1913 it was imperative to consider every possible economy. We are running to-day with a reduction of about 35 conductors. The present cost of an adult conductor, based on the same rate as a motorman, including his holidays and uniform, less the additional amount paid to the one-man car drivers, amounts to about £190 per annum. Nearly all tramways in Australia are running with adult conductors excepting our own undertaking and another, and generally this is the practice here. If the comparison is therefore made with adult conductors to agree with the conditions here, the above represents a saving of some £6,650 per annum on a total tramway revenue in our case of £50,000 per annum. It should be remembered that, in addition to saving the conductor's actual wages when on the car, there is his signing-on time, meal-time allowance, his annual holiday, and cost of uniform, together with saving in tickets, ticket-punches, way-bills, signing-off time, and the office cost of checking the way-bills. It is possible also to make some savings in the cost of inspection.

Our system of one-man car operation was fully described in the *Electric Railway and Tramway Journal* for September 3, 1915, but a brief description may here be of interest. The average speed of the two undertakings is nearly eight miles per hour, and it has only been found necessary to slightly lower the previous scheduled speed on two of the routes. The cars are all single-deck, and are converted for one-man operation by attaching hinged gates to each end of the car on both sides. The rear ones are kept closed, the entrance and exit being effected by the front gates adjoining the motorman. The fare-box is hung behind the driver and adjoining the entrance into the car. Arriving at the terminus, the motorman carries it to the other end of the car. There are hinged notice-plates just above the dash, one side notifying "Pay as you enter" and the other side "Pay as you leave." This system, I believe, was originated by us, and has the following advantages—

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Cars travelling from the suburbs to the centre of the town notify "Pay as you enter" at each end of the car, because passengers are picked up in small numbers along the route and leave the car often in bulk when they reach the centre of the town. Cars travelling to the suburbs notify "Pay as you leave," thus enabling the heavier loading in the centre of the town to be effected without any delay in the collection of fares. The "Pay as you enter" notification is a hint to passengers to get their fare ready before boarding, and the "Pay as you leave" notification gives them time when in the car to get their correct fare ready.

FARES, FARE-BOXES, AND SYSTEMS OF CHECK.

The fares on the one-man cars at Ballarat consist of 2d. and 3d. cash, with a very small proportion of 1d. fares, and celluloid tokens of the value of 7 for 1s. and 5 for 1s., which can be presented as an alternative to a 2d. or 3d. cash fare. At Bendigo there are only 1d. and 2d. cash fares in use on the one-man cars. On one route at Ballarat there are, in addition to the above, a 3½d. and 4d. cash fare, and at Bendigo a 6d., 5d., and 4d. cash fare. When there are many different fares on a route the one-man operation admittedly becomes difficult of application, and we have only introduced this system on the suburban end of the former route. When arriving at this section the conductor from town boards the upgoing car. Cars proceeding from town have all the fares over the one-man car section issued by the conductor, and the motorman has only to see that local fares on the one-man car section are placed in the fare-box. Passengers boarding the cars at the suburban end, if travelling beyond the local one-man car section, are presented by the motorman with a slip marked 3½d. or 4d., as the case may be, and when the conductor boards the car he collects fares and issues tickets accordingly.

The fare-boxes, specially designed by us, are of simple construction, the coin or token falling on to a plate positioned inside the box with two sides glass, which plate can be tilted by the motorman, the fares then falling into the lower receptacle.

A looking-glass reflector is arranged inside the glass box, which assists in making the payment of a fare as public an operation as possible. I believe that this method constitutes a strong moral check, and that missed or incorrect fares rarely ever occur; in fact this system ensures probably less irregularities than with the ticket-punch system. The inspectors do certain duties in private clothes on these cars. The motorman does not handle any fares, which will be recognised as an advantage, but only gives change when necessary or sells the tokens. The motorman, of course, has to be relied upon to watch over-riding, in the same way as is done by a conductor, and we believe that there are few of this class of irregularity.

REDUCTION IN ACCIDENTS.

One-man car operation, with passengers entering and leaving at the motorman's end, obviously leads to a reduction of accidents. There is frequently a weakness in the link between the conductor and motorman, and boarding or alighting accidents ensue. In our case a reduction of these platform accidents has been most marked; in fact, reduced to about one-eighth. What is very convincing is that the company, insuring us against third-party claims, have reduced our premium four times, or a total of 40 per cent., since the introduction of one-man cars.

THE APPLICATION TO EXISTING ROLLING STOCK.

To those undertakings ordering new rolling stock the Birney safety type of car, with its labour-saving provisions, would no doubt appeal. Many undertakings, however, cannot in these days face new rolling stock. In our cars there are entrances at both ends of the car on each side of the same, and some systems here have their cars so designed. Where the entrance at the motorman's end is only on the right-hand side, then it would be necessary to alter this to the left-hand side, changing over the stairways when required. Many cars are already fitted with folding gates, so no additional expense would here be incurred. The Tramway Union, as might be assumed, did not take kindly to our innovation at the start, over-estimating the slight additional duties required by the motorman. We have had no trouble with the Union since the start, and they honestly realise that the cars can be run with one man and give satisfactory service to the public, and that our finances cannot stand the cost of two-men operation. The motormen on one-man cars get 5s. a week extra, and the additional duties are so small that all the motormen press to take these duties in rotation. There must be many small undertakings working under serious financial strain who could, at no great cost, alter their cars and put them into one-man operation. Many of our larger tramway undertakings may have non-paying routes or routes with light traffic at the suburban ends which could be similarly changed over.

I trust that these few notes will prove of sufficient interest to promote a discussion on the subject, and eventuate in some trials of this system.

RAIL SECTIONS.

Recently I was one of a committee to decide a new tramway rail for Australian conditions, so I have given a good deal of consideration to rail sections. I have had some correspondence with my friend, Mr. Frederick Bland, of Edgar Allen and Company, and he informed me at the beginning of this year that the British Standardisation Committee for Tramway Rails were reconsidering the section and were proposing to have a 9 in. radius curvature on the running tread, and the coning of the remainder of the tread to be equal to 1 in 10, also that there was a proposal to deepen the groove to 1⅜ in. I understand that nothing is yet finalised.

The coning of rail treads and wheel treads is worthy of deep consideration by tramway managers, particularly as I know many object strongly to the proposed new standard increasing the coning from the now 1 in 20, when they consider that it would be better to revert to a flat rail and wheel tread. Ten years ago, when sending in my views to the Corrugation Committee, I strongly urged that rail and wheel treads should be flat, because I believed that coning the same tended to create corrugation. On my old undertaking at Burton-on-Trent we had flat rail treads, and I ran wheels with flat treads on the same without any fillet. I noticed at that time that corrugation appeared more quickly on British standard rails and wheels on an adjoining system than it did on our own. I believe that the coned rail tread has been handed down from railway practice, yet in Australia to-day many of the railways have reverted to laying their rail-heads level, and not inclined as previously. I would be interested to know the practice here and on the continent.

Mr. R. B. Holt is well known for the close consideration he has given to rail problems. He holds the view that, as the majority of the wheels wear to a certain profile, the rails should be rolled to agree closely with the same. To effect this an inclined and rounded head, he contends, is necessary. With new wheels and track true to gauge there must always be less wear on the flange side of the wheel owing to the side sway of the wheels. As the flanges become thinned this is accentuated. I suggest that the coning of rail and wheel treads and the extent of filleting adjoining the wheel flanges has a bearing on the average wheel profile, and that wheel treads may not necessarily wear to Mr. Holt's design if flat rail and wheel treads had been in use. Generally speaking, as the life of a rail is decreased by wear the coning of the rails is increased, and I suggest that the serious amount of coning to be found on some of our tramways demands the very closest investigation as to the reason of same. It must be obvious that such rails working in conjunction with the badly-coned wheels one often meets constitutes a most defective combination from an engineering point of view. Every side sway of the car brings in a variation of the driving diameters on the pairs of wheels, thus accentuating the side play. This necessarily results in wheel slip, and additional wear on both rail and wheel, which, of course, cannot occur without increased current consumption.

I was recently riding on the Plymouth track, on which the rails are worn very badly coned, and the excessive side swaying was very noticeable. I have prepared a print showing sections of worn rails on several English tramways, some of which were sent me some time ago by the courtesy of the respective managers. Some of these sections show rail planing which had been or was proposed to be carried out, and this is only of interest at this juncture because the worn section given is that which is present when the wheel flange bottoms the groove and the rail is therefore worn out. It must be admitted that the coning of the rails by wear of some of these sections is most startling, and I give below the estimated percentage of the original life of the rail which has been lost due to coning by wear. In each case I have assumed the wheel flange was nine-sixteenths inch deep—

LIFE LOST DUE TO CONING OF RAIL TREADS.

	Depth of Groove in ⅝ in.	Coning in ⅜ in.	Per cent. of original life lost.
Bolton	31	4	15·4
Oldham, Ashton, and Hyde	31	4	15·4
Huddersfield, Up	40	2	4·5
,, Down ...	40	7	16·0
Cardiff	40	14	32·0
London United	28	9	45·0
Wigan	30	4	16·6
Edinburgh (Cable) ...	29	6	23·0
Melbourne (Cable)	26	1·5	6·2

I also show on the drawing sections of the Melbourne and Metropolitan Tramway Board's cable tramway rail, in which it will be seen that the origin level tread rail shows very little coning, even when excessively worn. I also show two sections of our rails in use at Ballarat, where for many years we have run flat-tread wheels on the same with the fillet against the wheel-flange removed. It

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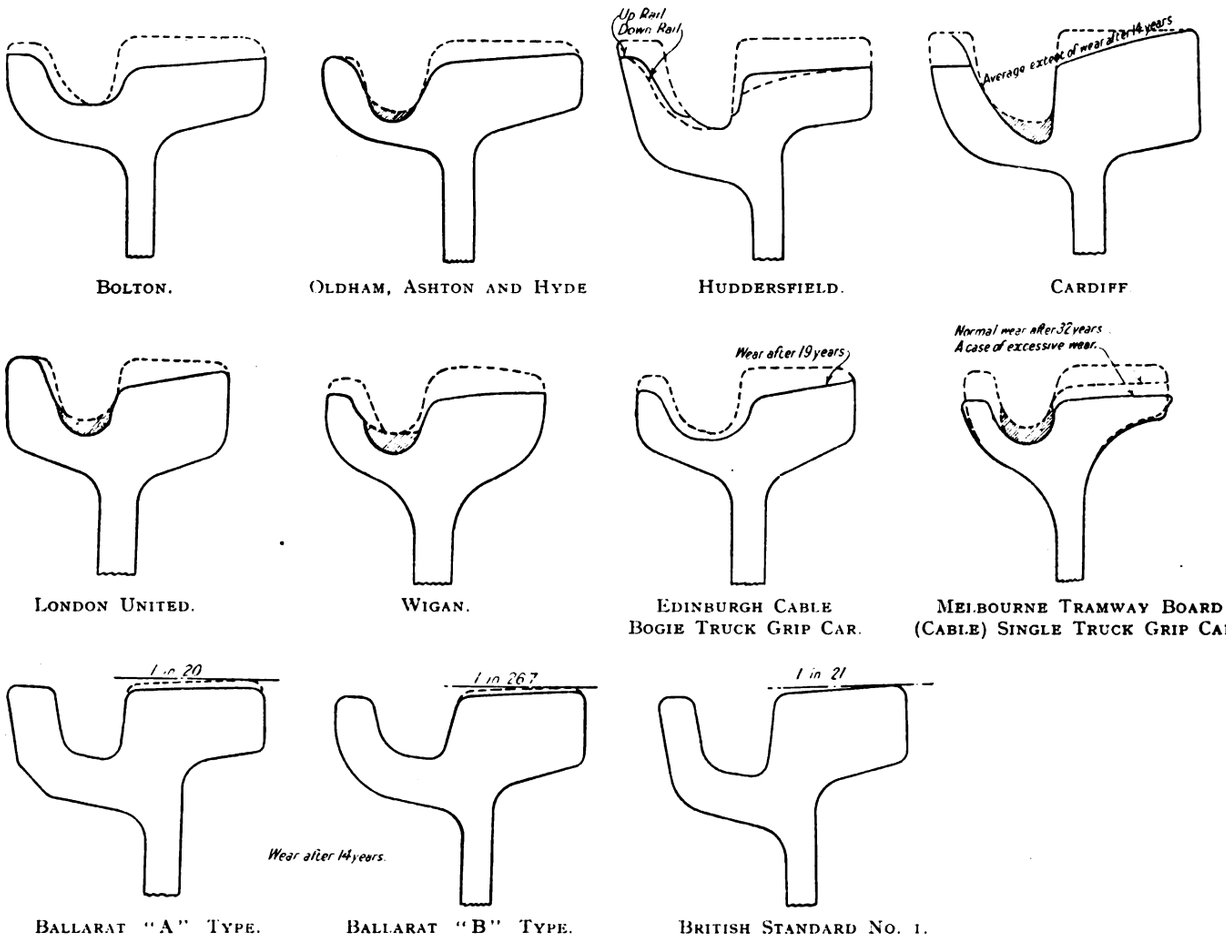
will be seen that the coning is practically the same as it was originally. Many of the rails shown in the drawing, if the excessive coning could have been reduced or eliminated, would not have required the groove planing to extend their life, but would instead have had many years of useful life before them. This loss of life through excessive coning assumes enormous importance with the present day cost of rail renewal. Again, when wheels become worn excessively coned, there is considerable loss of life in returning them to the B.S. I think it must be admitted that a wheel tread tends to wear less on the flange side, and that this tends to induce more wear on the groove side of the rail tread. It is possible the presence of dirt in the groove may assist in this effect. In face of the above, why therefore commence the life of our rails with the treads rounded and coned with a combination of coned wheels? An increase in the coning of rail treads by wear admittedly shortens the life of a rail; therefore why not postpone this coning effect as much as possible by starting off with flat rail and wheel treads? I would suggest that the Rail Standardisation Committee should suspend

where there is excessive tight or slack gauge. Where this occurs, and particularly so in the presence of a tight gauge, pronounced corrugation can be found for short lengths. On one route which is run with bogie cars very slight corrugations can be found in a good many places on straight track. I believe this explanation is due to the fact that a bogie truck will, when hauled by a cable, be subjected to more side-swaying action than a single truck, and that the presence of coning on the wheel will in these circumstances have a more pronounced effect on wheel slip.

A comparison of the wear on the Edinburgh and on the Melbourne Cable Tramways will here be of interest. The coning of the rail treads in the former is four times as great as the latter, with very much greater annual rate of wear, and the life lost 23 per cent. as against 6·2 per cent.

All the Edinburgh cars have bogie trucks, and corrugations are very pronounced on routes I have seen. Their weight per axle is more than double the Melbourne cars. I hold the same opinions as expressed by me over ten years ago—that flat rail and wheel



BOLTON. OLDHAM, ASHTON AND HYDE HUDDERSFIELD. CARDIFF

LONDON UNITED. WIGAN. EDINBURGH CABLE BOGIE TRUCK GRIP CAR. MELBOURNE TRAMWAY BOARD (CABLE) SINGLE TRUCK GRIP CAR.

BALLARAT "A" TYPE. BALLARAT "B" TYPE. BRITISH STANDARD NO. 1.

Sections Showing Coning of Rail Treads.

their present proposals, and that careful tests on several systems be made as follows—(1) The extent of side swaying of the cars on systems both with badly and lightly coned treads and wheels compared with wheels turned up with flat treads; (2) that current consumption tests should be taken in the tests above; (3) that if any undertaking is to-day running with an original flat-rail tread in conjunction with a flat-wheel tread, the resultant coning of the rails should be carefully investigated. Holding the views I do, it was of considerable interest to hear from Mr. Bland that France has lately abandoned the radius head and gone in for perfectly flat rail and wheel treads. This seems another reason why the subject is deserving of further consideration by the Standardisation Committee. The slipping effect on straight track, which must be present to the greatest degree with a coned rail and wheel, with, I believe, greater side-swaying action, may have a bearing on our corrugation troubles. When the above conditions are combined with the large diameter fillets to be found on many wheels, the slipping effect is intensified. It may be of interest to mention that on the Melbourne cable tramways, on which I have carried out a considerable amount of inspection work for the Board, rail corrugations are non-existent on routes over which single-deck cars are run, excepting

treads combined with the minimum of fillet to the wheel flange and the rail tread adjoining groove have an important bearing on the formation of corrugations. Means should be taken by specially designed brake blocks to retard the formation of a fillet on a wheel flange. I should very much like to see some undertaking reconstructing a route or laying down a new one to adopt the above combination.

The function of the lip or check of a tramway rail in a straight track is not to guide the wheel flange but to support the paving. In Australia we have evolved a rail which is a combination of the B.S. and the American design of lip, which projects out from the bottom of the groove at an angle of about 45 degrees. Our present B.S. lip, in the presence of dirt in the groove, undoubtedly increases the tractive effort, and the groove, from its shape, has little self-cleaning effect. There is no reason why home conditions should prevent such a type of rail being considered. The B.S. lip also narrows the groove in the later life of the rail, and there is considerable check action between the wheel and the lip, particularly when flanges are thinned by wear. In addition, the flange can bottom the groove before the maximum depth provided can be utilised. There are other criticisms that can be levelled against

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the B.S., but my object is mainly to raise a discussion on the question of coned rail treads and wheel treads.

DIFFERENTIAL WAGES.

Great Britain's recognised standard rate of wages has always varied in different towns and districts, and has been based to some extent on the cost of living and conditions existent in the localities. These differentiations in wages have always had an important influence in the settlement or retention of an industry. The addition of a fixed war bonus to the original basic wage has greatly reduced the percentage of differentiation, and the added percentage increase to the basic wage, plus the bonus, has only slightly retained the differential principle. The demands now being made in some quarters for a national wage endanger the differential wages which have always existed, and I have thought that a brief reference to our industrial conditions in Australia might prove of interest and value at this juncture.

When I arrived in Australia at the beginning of 1911 I was faced with conducting our tramway case before the Federal Court. I found that the procedure of both the State and Federal Industrial Courts had been to grant a fixed wage throughout the whole State, although the Federal Court had differentiated in wages between one State and another. I prepared some tabulated statements from the English Board of Trade returns giving the standard rate of wages for various industries in most of our large provincial towns compared with London. A similar comparison was made between a number of provincial towns under 100,000 population. The differentiation in wages between the large cities and London varied from 10 per cent. to 12 per cent. less, and in the smaller towns from 18 per cent. to 22 per cent. As a result of the evidence submitted the Court approved for the first time of differential wages in a State, based to some extent on the variation in the cost of living. Since that date the Court has adopted this principle in all its awards affecting every State in Australia. I have also been enabled to get the same principle accepted in a large number of Victorian State awards. The Federal Court has awarded country towns and districts differential wages of 7s. 6d. per week less than Melbourne, our capital city in Victoria, and in some cases 10s. and 12s. per week less. It will be realised what enormous assistance this has been to industries situated outside the metropolis in each State. The fixed wage—in other words, a national wage—unquestionably caused many industries to leave country towns for Melbourne, and prevented the settlement of new industries in country towns. There is no country in the world in which centralisation is so acute as in Australia; for instance, nearly 60 per cent. of the population of Victoria are resident in Melbourne, and the conditions are almost as bad in other States. The Commonwealth statistician, Mr. G. H. Knibbs, prepares the most exhaustive statistics and cost of living figures, which are available every month and quarter in regard to all the principal towns in Australia. His figures are accepted in all the courts, and, generally speaking, by both the employers and employees. His inquiry relates to food, groceries, and rent, and 47 commodities are included in the former. These items represent about 60 per cent. of a worker's expenditure, and the Federal Court, after most exhaustive inquiries, considers that the balance of expenditure may be fairly taken to vary as the 60 per cent.

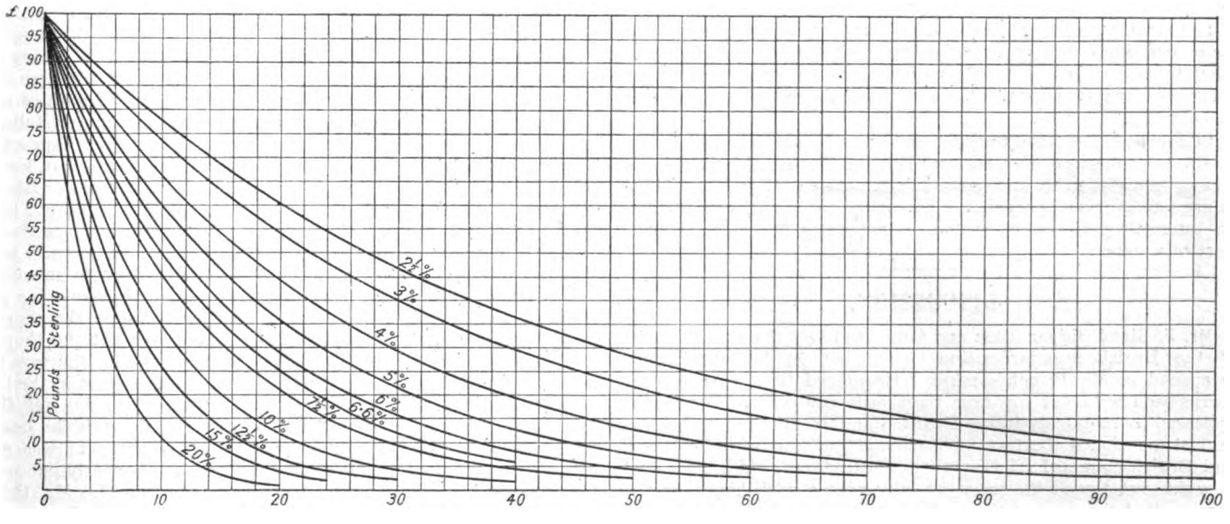
I give below as an example the index figures for the capital cities. The basic wage per week for an entirely unskilled labourer was, some three months ago, fixed for Melbourne at 71s. On this basis the wages to be awarded in other capital cities would be directly proportioned to the index figures as shown.

Index figures for food, groceries, and rent for quarter ending December 31, 1919, and corresponding weekly wage—

Melbourne	1567	71s
Sydney	1656	75s.
Brisbane	1543	70s.
Adelaide	1531	69s. 6d.
Perth	1436	65s.
Hobart	1609	73s.

The principle of differential wages is realised by many unions as being a perfectly fair and consistent one. In our towns, Ballarat and Bendigo, the cost of living figures are considerably less than Melbourne, and our agreements with the tramwaymen provide for a wage of 9s. per week less to motormen than the Melbourne rate. The opinions expressed in a recent case by Mr. Justice Higgins, the President of the Federal Arbitration Court, an eminent judge, and with no doubt the greatest experience of any in regard to industrial matters, deserve repetition. They are as follows—

> On this point there was a keen struggle between Melbourne respondents and other respondents. Naturally, Melbourne firms did not want their competitors in business to have the advantage of lower wages. If it were just he would be glad to pay all the respondents on the same level. There would be obvious advantages in a standard rate all over the industry, but he had found it impossible to refuse to discriminate as to the basic rate where there was a clear and substantial difference in the cost of living. The duty of the court in fixing wages was to do nothing to interfere with the natural advantages which one locality had over another. If in Ballarat and Bendigo men could live more cheaply than in Melbourne, the employers should not be forced out of consideration for the Melbourne employers to pay to labourers more than would be sufficient to provide the commodities upon which the basis wage was drawn up. The union would even prefer that there should be a lower rate in Melbourne and all the localities concerned rather than have the discrimination, but after careful consideration of the position and with regret he had decided that it was his duty to discriminate as requested.



EXAMPLE 1.—Say 5 per cent. depreciation on diminishing value is allowed, and the asset has an estimated life of 25 years, follow where 25 years intersects the 5 per cent. curve, and read opposite this point in the pounds sterling column the residual or scrap value that this asset is presumed to have, which in this case is £27½ in a 100, or 27½ per cent. of its original cost.

EXAMPLE 2.—If an asset has a life of 30 years with a residual value of 10 per cent., then follow which depreciation curve most closely runs through these intersecting points, which is 7½ per cent.

EXAMPLE 3.—If 5 per cent. depreciation is allowed and the residual or scrap value of the asset is 10 per cent., then where these figures intersect will give the assumed future life of the asset—in this case 44 years,

Effect of Depreciation at Different Rates on Diminishing Values.

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Should this country, through its politicians or through its wage settlement organisations, drift into accepting a national wage, then certain towns, districts, and industries must be gravely affected. The question is one of great national importance, and in its effect on industries it must involve the well-being of both the employer and the employee. The exodus of industries from our big industrial congested centres to rural parts with a lower standard rate of wage has unquestionably been of vast importance to employees in the improved conditions which they and their families participate in. The lower wage has never been an injustice, because under the lower cost of living existent in the rural parts their position is often financially better. The attempt to impose a national wage is absolutely inconsistent, and has no element of justice in it. Cost of living has been always the basis for a demand and for an agreement or an award. A fixed wage must do injustice to some workers at the expense of others. I believe rents for the workers have not been permitted to be increased, but eventually a time must come when rents will rise; and the local conditions in the various towns and districts must have a big influence on the same, and in consequence must enter into the fixation of wages. An acceptance of a national wage would make it impossible to provide for these differences, which may be greater in the future than they have been in the past. The past effect of a national wage has been only too self evident in Australia, and the gravest warning is necessary to those in authority that nothing should be done which should permanently injure the industrial welfare of this country.

DEPRECIATION.

Having brought with me a curve of my own design, it is possible that this may prove of interest and value to members. I have taken an active part both with the Federal and State income-tax authorities in Australia, which has enabled electricity and tramway undertakings to be put on a fairer basis in regard to their depreciation allowances. The curve (page 29) shows the relationship of depreciation percentage on diminishing values, life of an asset, and residual value, and it has been of service in our various negotiations with the authorities. We have also obtained the recognition of an important new principle in regard to certain depreciation allowances. Five per cent. depreciation on diminishing values has in the past been allowed on all power-station plant, this procedure being the same as that in force here. This percentage is also allowed to any factory or works working approximately 305 days per annum (Sundays and holidays excluded) on the basis of 48 hours per week. It is obviously inconsistent and unfair to only grant the same allowance to undertakings which run continuously all the year round. The Federal authorities have courteously considered this aspect, and now grant 10 per cent. depreciation on diminishing values for all power-station plant and 5 per cent. for all tramcars. With the enormous increase in the replacement cost of assets which compose our tramway and electrical undertakings, it is obvious that the old depreciation allowances want entire revision. If the replacement cost is double the original, then a 5 per cent. allowance is really only equivalent to 2½ per cent.; otherwise it assumes that the life is now double what it used to be. I should be interested to know whether any action has been taken with the authorities here on the lines indicated above.

In conclusion, I have touched upon several subjects which have no direct connection with one another, but I trust in doing so that I have been able to hit upon some subjects which will be of individual interest to everyone present. I hope that my remarks may induce an interesting discussion, which is frequently the most valuable part of a paper.

DISCUSSION.

Mr. F. Bland (Edgar Allen and Company) said that, as a member of the British Standardisation Committee, he had been much interested in Mr. Pringle's paper. He agreed that there was less corrugation with flat top rails than with any other. Corrugation appeared more quickly in the British standard rail, and he believed he had mentioned the fact when corrugation was being dealt with and British standard rails were being introduced. When Mr. Holt brought out the 12-in. curve he fully agreed with him that that curve suited the wear of the modern rail, but we had not got much further with the problem of the wheel fitting the rail or the rail fitting the wheel. The London County Council asked for a 6-in. radius, which they considered best, but that was an excessive radius. Liverpool used a 9-in. radius, Manchester preferred 12 in., while others again preferred a flat rail or a cone of 1 in 21. The German standard rail was 6 in., very similar to the London County Council; the French old standard was 12 in., but France had now adopted a perfectly flat section rail. The French had gone thoroughly into the question, very different to this country, and gave their reasons. The chief engineer of the omnibus and tramways undertaking in Paris was to have read a paper at the International Congress in Buda-Pesth in 1914, but that did not come off, owing to the war. Since then the paper had been published in a French journal, and when translated was very interesting. The engineer said there were 21 companies who had adopted the flat top rail, and others who had not adopted it did not raise any objection. But the bulk of French opinion was that the flat top rail was best, so much so that the French Standards Committee—which was far more go-ahead than the English Standards Committee—had adopted it permanently. In this country there had been used a revised rail of 12-in. radius, but it had never been officially adopted. Manufacturers and rail makers had worked to that rail, and this fact would affect any new section issued, because some hundreds of miles were laid in this country with this section. When they came to adopt another section, or one proposed to have a deeper groove, then there was difficulty with repairs. The deep groove section was all right for new work where all the rails could be laid alike, but it failed for renewals on old tracks. He certainly advocated a deep groove. He thought Mr. Pringle's suggestion in his paper as to flat rails and wheel treads could still be carried out (No. 3). Certainly he did not compliment Australia on their proposed standard, with all deference to Mr. Pringle. He rather called it a hybrid system. They seemed to ignore English ideas and to have adopted the American, which was not very complimentary to this country. He understood they had a Commonwealth Department known as the "Science and Industries Bureau" that dealt with these matters; but if this section were adopted they would have the same difficulty in renewals as he had pointed out would be the case with the revised English rails.

Mr. C. J. Spencer, dealing with the question of the flat rail, said that at a town not far removed from Leeds, which he knew very well some years ago, they had a good deal of trouble with side-swaying and tail wagging, and they found quite accidentally that by turning the tires flat they stopped that trouble. When the wheel tire had a flat face there was no side-boxing of the car. Now he thought there was something rather interesting in that, and that it gave some credence to the belief that a flat rail and a flat tire make the best track. With regard to the American section of tramway rails, he certainly liked it from a tramway point of view; but he was not so sure that an ordinary road user would have cared for it at all, and that was the great difficulty, for road users had to be considered to a considerable extent in this country.

Mr. W. E. Ireland (rolling stock engineer, London County Council Tramways), dealing with rail sections, thought that engineers would rather have a flat tire than a flat rail. Those who had experience such as they had in London must agree to this, but they must also agree that it was physically impossible to keep them in condition. The worn shape of the rail was brought about by the shape of the tire, and that shape was usually cone. The extent of the cone to a very large extent depended on the area of contact. The area of contact had a very great bearing on the subject, as was established by some experiments they had carried out. The load per square inch worked out somewhere about 65 tons, and some tires used in this country carried about 70 tons. Taking half that tensile strength, they would find they were loading the tire to such an extent that it could not stand it for any length of time. The consequence was that squeezing out took place. It followed that whatever rail was put down it was rolled to the shape of the tire. That was why he did not think it was possible to run for any length of time flat tires on flat rails. It was an ideal condition if they could maintain it, but he submitted that they could not maintain it for any appreciable period. If they were to maintain it then they must consider the cost of returning the wheels every quarter of an hour. (Laughter.) What Mr. Pringle mentioned bore somewhat on Mr. Spencer's remarks, viz., that there was a good deal of boxing going on, and that was attributed to the shape of the rail or tire. His experience was that it was not the shape of the tire. It was nearly always due to the fact that the two tires on the same axle were of different diameter. Put them in the lathe and turn them, and the boxing was stopped. He did not think the cone on the wheel or rail had anything to do with the boxing. They knew the weight per axle of the Edinburgh car was more than double that of the Melbourne car, and consequently one would expect the cone to be very much more pronounced. Mr. Pringle suggested that "brake blocks retard the formation of a fillet on a wheel flange." He could tell Mr. Pringle that whatever type of brake block was used, it would not influence the shape of the tire in the smallest degree. He had proved that up to the hilt, for they had in their repair depot carried out a number of experiments to ascertain to what extent the braking of the car did wear the tire. They put on a marked tire heavy loads, and after running some 300 miles the marks were not off the surface. He thought that went to show that no brake block had any effect upon the shape of the tire, and the reason was very palpable. It was hopeless to try to maintain the shape of a tire by means of the brake blocks.

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Mr. R. B. Holt (London) remarked that there were many things in the paper one could join Mr. Pringle on, but the difficulty was to select the more important. Mr. Pringle had referred to his—the speaker's—published opinion in regard to rail design, and whilst he still adhered to that opinion, he would like to say that he was not prepared to carry out the coning of rails as described. At the same time he was entirely opposed to increasing the rail head. If the Standardisation Committee contemplated the inclination of the rail tread to 1 in 10, notwithstanding the fact there was a member of the committee present, he had not the slightest hesitation in saying that was wrong both in principle and practice. He was very pleased to hear that there was at least one member against it. At this juncture, in discussing the inclination of the rail it was very difficult to know what the Standardisation Committee were doing. They never seemed to consult anybody outside, and he had been unable to get any information of any revised section they had designed. There seemed to be a little misunderstanding in regard to the idea which the original inventor of the coned rail had in mind. As far as his own knowledge served, they were originally made conical in order to centre the car on the track. From that point of view he objected very much to the idea of abolishing the wheel fillet. Another old idea that coned wheels and rails were not safe was absolutely erroneous. Any advantage which might be due to the use of coned wheels was nullified on ordinary British tramways by the fact that to suit the camber of the road or highway the left-hand rail was depressed by an inch. He knew that on the London County Council and Metropolitan lines that was not so, but it was true of most provincial tramways. For that reason again the abolition of the wheel fillet was disadvantageous. Another reason for objecting to the abolition of the wheel fillet was that they were thus weakening the flange on sharp curves. He had intended to make some remarks of his own in regard to the coning of new rails and tires, but after what Mr. Ireland had said he had better not make them. At the same time he would like to say that he had undoubted evidence that the use of track brakes on rails had a very definite effect on the coning and wear of the rail, and moreover that reacted on the wheel itself. It must react and be a party to it. There was a point arising out of that which he would like to mention, and that was the destructive effect of track brakes applied in such a way as to pull up a heavy car in its own length when travelling at full speed. It was definitely settled that there was coning of the rail by braking in such a way, with rapid disintegration of the metal at those points. His opinion on rail design generally was governed by the fact that nowadays no new tramways were being laid. The design of rail and wheel was controlled by existing conditions. With the tires thay had, and on a big system, he did not see how they were going to convert to a flat top rail without closing down for a period. It was not possible except perhaps on reconstructed track and extensions. At present under existing conditions they could not see where any advantage was to be gained. He agreed with Mr. Ireland as to the maintenance of wheels of the same diameter; that was the problem—the wheels did not wear to the same diameter. As a member of the Corrugation Committee, he recollected the point that one could not wear four wheels alike. He thought that in itself was sufficient to account for side-slipping. But the fact remained that no one was in a position to replace wheels and tires at the same time.

Mr. C. J. Spencer said he could not absolutely agree with his friend Mr. Ireland on the question of the effect of the brake block on tires. Mr. Ireland had given them an example of where a shop test had been made, and as he understood it the result was to the effect that after the shop test he could not find that the wear of the tire from the brake block was of such moment as to be worth talking about. Well, a shop test and a road test were two entirely different things. In Bradford they found that with cars which were almost entirely braked on a track brake shoe the life of the tires was at least double the life of the tires that were braked in the usual way. Not only that, but the contour of the tires where they wore was altogether different from those which wore from cast-iron blocks. He suggested, as an explanation of the difference between Mr. Ireland's experience and his own, that in all probability the wear was occasioned not so much by the cast-iron block as by the grit from the road. The tire was ground down, not worn down. That was his own experience, and it was quite contrary to that of Mr. Ireland.

Mr. Ireland explained that his experiments were made under working conditions. He thought the reason they got wear on tires with brake blocks was not that the brake block ran on the tire, but it was due to the effort the wheel had to make in bringing the car to a rest. The brake block checked the work done between the rail and the wheel. He did not think they wore the tire with the brake block under any conditions.

Mr. A. W. Mason (London) said he rather differed from his chief, Mr. Spencer, in thinking that the wear on tires with control down on the rails was just about the same as when braked with an ordinary cast-iron block. He thought Mr. Ireland's view of excessive coning was correct. It was a case of the old-fashioned rail with a narrow tread. In M.E.T. cars they did not get nearly so much coning as in others, and he thought it was really due to the number of tons to the square inch.

The Chairman thought that both Mr. Ireland and Mr. Spencer were right in a sense. The difference was in the retardation of the wheel by the application of the brake block—not necessarily the wear, as Mr, Ireland pointed out, between brake block and wheel, but the wear due to the application of the brake block may be between the tire and the rail. He wished to clear up one point with regard to the Engineering Standardisation Committee mentioned by Mr. Holt. He happened to be a member of that committee. Mr. Holt asked for publicity as to what the committee were doing, and whether anybody was consulted as to what was being done. He was afraid that a lot of the troubles arising at the present moment were due to the fact that perhaps for the first time in considering sections the proposals were issued to the Tramway Associations to obtain their views. So there was a great publicity. What was the effect? Those people came along and talked about a new British standard section. There was no such thing as a new British standard section. A large user put forward a section which he considered was a good one; other people objected equally strongly, and there was a very strong difference of opinion, and he quite accepted what happened at that Congress. The whole question had turned on the design of rail head. At the present moment he thought the matter was left largely to himself and Mr. Fell to get out a section which it was proposed to consider tentatively as an additional standard at the moment. It was going to be a very heavy rail, because the London County Council, which had a very heavy traffic, desired to have a rail heavier than any rails at present in use. Probably if the committee do depart to any large extent in regard to the depth of the groove (which was one matter under consideration) and in regard to the form of the tread, it would be in order not to supersede the whole of the present standards in use, but to apply those rails of new section (which of course would not be a rail to be coupled up with other rails) to just a few undertakings. He was bound to say that his experience over a large number of tramways had been that the rail which originally started horizontal and had been in use with flat tires had worn the best. The Oldham-Ashton rail was of that description. The original rails were still in use after about 22-23 years' service. He quite agreed that every rail would tend by degrees to wear to a slope; but that was due to a good many factors, even to wheels of ordinary vehicles run on the rails, and due to the necessary clearance given, which meant that there was always a certain amount of swing going on. It was also affected in some cases considerably by the use of magnetic track brakes, which had a tendency to work into the groove and wear the tread adjacent to the groove more than the outside edge. Early tramway rails no doubt were designed to follow railway practice, and the railway practice was to have a tilted rail, as is the case to-day. The standard rail was tilted somewhat, the off-wheel flange a good deal, with considerable action and deep throat. The result was as expected in those days, that it eased matters going round curves, and was considered to steady the track and make the running better. But tramway conditions were now quite different. If he had to put down a new line to-morrow he would like to have a horizontal tread and horizontal tire run. But they had to face present conditions. They were tried to-day with a large amount of renewal work, and the best way to deal with that—and he thought Mr. Holt long ago worked on the same lines at Leeds—was, while not having a great inclination on the rail, to have a considerable radius on the tread of the new rail. The result of that was that from about 1 in 7 up to horizontal they would always get the line of the tire tangent on that groove, and in a very short time it would bed itself. They could not design a rail with a slope that would suit every undertaking, because his experience was that the slope varied with every undertaking, and not only varied on every undertaking, but also in different parts of the same undertaking to some extent, but not perhaps to as great an extent as between different undertakings. Therefore what they had got to aim at was a profile on rail top which was suitable for new work, and at the same time gave the maximum amount of wear in the rail, and a tire with such a considerable slope on it as would bed itself readily, and very shortly there would be a good running surface to work on.

There were other very interesting things in the paper, but he would not deal with them, because time was passing quickly. One thing he would like to tell Mr. Pringle, however, was with regard to differential wages. He thought at the last meeting of the National Council for the Tramway Industry the whole fight turned on the question of the introduction of differential or graded wages. It was fought very hard by the unions, but in the end grading had been adopted, and it had always been the foundation of the method of payment in this country in the past. But during the war a tendency

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came in to have flat war wages, and of course now that wages are becoming more or less stabilised, the war wage money has been converted into the ordinary wage; but there was no doubt that the conditions of work in London, Birmingham, Manchester, and so on, were absolutely different from those at Worcester, Taunton, Llandudno, or other small places. Houses are cheaper, people could go home to their meals, live close to their work, and other conditions were different. He only mentioned the fact so that Mr. Pringle might not go away with the idea that they were giving up the idea of differential wages in this country. As to the one-man car, he had considered the matter, but unfortunately they had a steep gradient, and he did not know whether the Board of Trade would approve the use of a one-man car under such conditions. If Mr. Pringle had had any experience in that respect in Australia he was sure the Congress would be glad to hear of it.

Mr. H. P. Stokes (general manager and engineer, Plymouth Corporation Tramways) expressed the opinion that coning was primarily due to the use of track brakes, resulting in wheel wear. As to one-man cars, he had had a number at work for some years, and the average revenue per car-mile was 8½d., but this showed a slight increase in 1919. He thought this low revenue, compared with the other parts of the undertaking, was due to the fact that no smoking was allowed on the cars, though smoking was permitted in the vestibules at either end. It did not make very much difference when the service was doubled, for the revenue dropped down to 6d. without any notification to the public of the better service. These demi-cars were withdrawn from the service and replaced by double-decked cars, and the traffic revenue went up to 15·6d. He believed conservatism had a good deal to do with it, but the one-man car might serve a special use. They tried them on another route. The demi-car was a fast car, seating 34 against 46 in the double-deck car. They were put on at the peak load period, and the revenue was 18·5d. against 22·6d. There were more accidents with the one-man car than the ordinary type on which two men were employed. This probably arose from the man having his eye inside rather than watching to see what was coming in the opposite direction. These cars had also been tried for special forms of traffic; they also tried the pay-as-you-enter system, which was usual on those cars, but the loading up was obstructed, and traffic was rendered difficult to such an extent that they dispensed with the system, and for a little time put on a conductor, who boarded the cars, collected the fares, and hopped off again, and negotiated other cars, in order to get them out of the way. They also tried sending the cars away full of passengers and collecting the fares as they got off, because Plymouth people objected to the pay-as-you-enter system. The general opinion he had come to was that these cars were not suitable for our conditions of operation. They might be of value on an inter-urban system where the traffic was of a light character, but for dealing with places where there was density of traffic such cars were a nuisance themselves and a nuisance on the roads.

Mr. Pringle, replying to the discussion, said it was interesting to hear Mr. Bland's views as a member of the Standardisation Committee, and to know that he approved the principle of flat rails and flat wheel treads. In regard to the Australian standard, it had to be admitted that it was a bit of a conglomeration. He did not know whether any of them had carefully studied it or tried it, but that was the standard they had adopted in Australia.

The Chairman.—The Board of Trade, I am afraid, would not pass it.

Mr. Pringle said that possibly they would not. It was not entirely reverting to American practice. They had adopted the British standard design coupled with some American views. He thought they had a very conservative body to deal with. In Brisbane they obtained satisfactory results, and they believed that by the use of their rail the flange action was reduced. No doubt the lip did not carry out that intention at all. He was also interested to hear that Mr. Spencer did approve the use of flat wheels and treads where it was possible. Mr. Ireland considered one could not control the coning of rails at all, that it was a necessary evil, and what is must be; but he (the speaker) thought the general conclusion seemed to be that coning was a bad feature, with a serious effect on corrugation, and would undoubtedly shorten the life of the rail. But he desired to ask, admitting all its bad effect, why start off with coned rails and wheels, intensifying the trouble from the start? Why not start off with the flat, and endeavour in every possible way to reduce the weight of the coning effect? He had shown a section of Ballarat rails, where they had been able to maintain a coned track throughout originally with flat wheels. He thought it would pay many undertakings to consider using a flat wheel on a badly coned track. It certainly would not accentuate the coning, but would tend to reduce the rate of coning. Mr. Ireland referred to the fact that the Edinburgh cars were double the weight of the Melbourne cars, and that coning was entirely due to that. But there was also the corrugation effect that he had referred to; this was found in a system in which there was a big side-swaying action going on. In Melbourne, with flat rails, it was non-existent, but that might be affected by the weight per axle. He thought the whole point was worthy of further examination, and he thought they had a connection in some way between coning of the wheels and corrugation. He was also interested to hear from Mr. Holt that he did agree with the use of flat wheels and rail tread as possibly desirable, but he also indicated the difficulty in maintaining that and in dealing with repair work with that type of rail. A great deal too much was made of the difficulty of making repairs with other rails of a similar British standard. The work necessary in the way of fishplates, filing down and joining rails of British standard section was quite a big problem, and it was only made a little more difficult by putting in a flat rail. Still he did think the problem was serious, and as at the present time many systems were not making repairs (except short lengths) and postponing the question of general renewal throughout, why therefore could they not consider an improved rail, if it was admitted on all sides that a flat tread was more desirable combined with a flat wheel. He had been much interested in the argument between Mr. Spencer and Mr. Ireland as to whether brake blocks had any effect on the wheel. Of course those experiments were made with the ordinary form of brake block. Still he did not think it impossible to design brake blocks which would have some effect on the wheels and assist in reducing as much as possible the formation of a flange. It might be noticed that in the French standard rail, to which Mr. Bland referred, there was an exceedingly small flange, almost a sharp edge. Other engineers were working in the same direction, and he did not think they should mind saying the correct thing, i.e., that it was worth while studying the other man's point of view. Mr. Howley also agreed that a flat rail tread was desirable, and his (the speaker's) remarks with regard to the difficulty of dealing with repairs would answer some of Mr. Howley's queries. He did not think it was at all an insuperable difficulty, and considering the enormous cost of rail renewal in the future, it would be a tremendous advantage for them to reduce the coning and get a longer life from the rails. Mr. Howley had also referred to the use of one-man cars on steep gradients. In Australia he had certain cars working on gradients of 1 in 14 or 15, and they had never had any accident. When it was remembered that they had one-man driven motor omnibuses and chars-a-bancs driven on all sorts of gradients, were they not making a little too much out of sending a car out with one man? He had had a great difficulty in getting the courts in Australia to agree to the one-man proposal. Naturally one might think the introduction of the one-man car, was easy, and not a matter for the courts at all, but the president of the court thought otherwise, and only allowed it to be introduced on one route. However, after one or two visits to watch the working of the system, he came away perfectly satisfied of its utility and safety to the general public. Only after these inspections were they allowed to proceed with other routes. Mr. Stokes thought that coning was due to the continuous use of track brakes, and he supposed that others could confirm that that is the case; but some of the systems did not use track brakes, and yet there was serious coning to be found. Cardiff was a particularly bad example of coning owing to the track brake in use there. Mr. Stokes' remarks with regard to one-man cars at Plymouth certainly showed they failed there, and if that was the experience they were likely to get anywhere else it would certainly condemn their introduction. But Plymouth was a town where there was a considerable traffic. He did not know what their fares were, but they might not have been suitable for the car. Mr. Stokes' opinion was that such a car was not suited to the system.

Mr. Stokes.—We had a universal penny fare there.

Mr. Pringle said that then there were no fare difficulties. In Australia they had comparatively few. The public to some extent might take objection to these cars. When he introduced them they had considerable difficulties to start with, mainly with the public. They had to educate the public to them, for they were very conservative when something new came along. The public were asked to have change available, and not unnecessarily annoy the driver by asking for change. Of course some congestion did arise when the system was first put into operation, people fumbling with their purses for change to pay as they entered and delaying others, but that state of things was very soon removed when they became used to the system. He was also surprised to hear that there had been more road accidents with one-man cars, because that had not been his experience at all. They had not transferred entirely to one-man cars; they still operated a number of two-men cars, and the insurance company—absolutely practical sort of people—were not affected in any way, and the fact that they had granted a reduction of 40 per cent. in the premium rates must be a substantial answer to the question whether general and platform accidents had increased. He did not think that really was a necessary adjunct to the system. (Applause.)

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The Chairman proposed a hearty vote of thanks to Mr. Pringle for his interesting paper, and said it was particularly valuable to have all this information from the other side of the globe. He hoped that when Mr. Pringle repeated his visit to this country he would come to their meetings and give them similar information to that which he had given them that day.

Mr. Pringle having acknowledged the compliment, the proceedings concluded.

THE ANNUAL DINNER.

In the evening the annual dinner was held at the Connaught Rooms, Kingsway. Sir Arthur Stanley, G.B.E., C.B., M.V.O., the newly-elected president, occupied the chair, and was supported by ex-president the Right Hon. Viscount Chilston, G.B.E., Sir James Devonshire, K.B.E., and a large attendance of members including the following:—

R. L. Ackland.
T. Alder.
T. P. Alder.
J. J. Ashbrook.
H. Baker.
Geo. Balfour, M.P.
A. G. Balfour.
A. L. Barber.
E. Barralet.
A. H. Beatty.
W. W. Beaumont.
H. R. Behen.
E. Benedict.
A. J. Bird.
D. E. Bird.
H. F. Blain, C.B.E.
P. R. Blake.
Fred. Bland.
E. Bond.
F. Bourne.
E. Boys, M.C.
C. D. Braidwood.
J. B. Browning.
J. K. Bruce.
W. R. D. Bruce.
P. Buckley.
F. Burfoot.
J. L. Burton.
J. F. Caine.
J. M. Calder.
S. H. Callow.
J. M. Cater.
Viscount Chilston, G.B.E.
W. W. Clark.
N. Clough.
H. P. Conibear.
W. Churcher.
C. F. Cocks.
C. F. Collins.
A. Coveney.
J. W. Crawley.
R. G. Cunliffe.
F. Coutts.
E. E. Daglish.
W. D. Dawes.
Sir James Devonshire, K.B.E.
A. de Turckheim, Secretary
J. Dobson.
C. Don.
E. H. Edwardes.
H. England, M.B.E.
J. W. Falkingham.
A. L. C. Fell, C.B.E.
H. J. Ferguson.
E. H. Fleming.
J. P. Fletcher.
W. E. Frier.
J. J. Fry.
S. A. Hackney.
S. Hann.
L. Harvey.
W. H. Hawley.
H. Hawley.
C. E. Hawkins.
F. Hewer.
C. W. Hill.
A. R. Hoare.
H. Holliday.
J. St. Hollington.
A. J. Hollington.
Thos. J. How.
C. T. Hodgson.
R. J. Howley, C.B.E.
P. M. Hunt.
A. C. Ingram.
A. H. Jackson.
W. D. Jeffs.
J. C. Jewell.
W. E. Jewell.
A. Johnson.
J. J. Kelly.
S. Kennedy.
W. H. Kimber.
C. Y. Knight.
E. M. Lacey.
E. H. Lean.
C. Leigh-Griffin.
W. L Lorkin.
S. Loosen.
J. McCaffery.
J. McLeod.
J. B. McKinnon.
D. McColl.
E Manly.
H. L. Marshall.
A. V. Mason.
Coun. R. Mayne.
G. A. May.
J. F. Moss.
E. M. Munro.
L. Myers.
H. A. Neale.
A. Paterson.
A. H. Pott.
P. J. Pringle.
A. H. Putten.
H. C. Palmer.
W. W. Richmond.
G. A. Roberts
W. T. Robson, M.B.E.
L. M. Rowe.
W. Rutherford.
F. E. Saunders.
H. F. Sayers.
F. Schofield.
H. Scholey.
A. G. Scowne.
G. J. Shave.
W. H. Shaw.
Hopking W. Shaw.
W. Shearer.
S. F. Sheers.
Hilton C. Shirreff.
R. E. Skipwith.
L. Slattery.
E. W. Sleight.
C. A. Smith.
S. G. Smith.
Ald. R. A. Smithson.
E. R. Soames.
H. K. Spark.
—. Speers.
C. J. Spencer, O.B.E.
Hon. Sir A. Stanley.
C. D. Stanley.
G. B. Stanley.
M. O. Spichnall.
W. A. Stevens.
H. P. Stokes.
T. E. Taylor.
A. J. Talbot.
C. R. Tattam.
C G. Tegetmeier.
W. J. Terry.
H. C. Thomas
T. E. Thomas.
Coun. A. Thomson.
J. B. Tippetts.
A. Toms.
H. E. Townell.
W. H. Troake.
H. J. Troughton.
W. W. Wakeley.
A. H. Walton.
F. A. Warlow.
M. Warlow.
G Warlow.
V. Wallington.
A. M. Willcox.
J. H. Williams.
A. Wilkinson.
J. E. Winslow.
W. S. Wreathall.
R. Yoward.

The loyal toasts having been honoured, "The Tramways and Light Railways Association" was proposed by Sir J. Devonshire, who, while deeply sensible of the honour conferred on him by being chosen for that duty, protested his unworthiness for the post. He had had the honour to serve as vice-chairman some years ago under Sir Arthur Stanley, and possibly that was the secretary's reason for choosing him. He would like to refer to the work of the National Trades Advisory Committee, set up by the Ministry of Labour to train the disabled ex-service men in connection with electricity—power and light. He happened to be chairman of that committee, and the Tramways and Light Railways Association was asked to nominate a representative on the committee—and they nominated himself. A busy time followed. There were 450 men in training now, either in technical colleges or in Government instructional factories. This training would continue for probably two years. After that time it was up to the association to try to absorb some of those ex-service men. The King's Proclamation asked employers to take about 5 per cent. of these men, but their own association had been responsible for absorbing 9 per cent., or 4 per cent. in excess of the King's request. On the committee he referred to there sat both employers and representatives of workpeople, viz., the Electrical Trade Union. Hard things had been said of that union, but on this question they had behaved admirably. When so much had been said about the hesitation of trade unions to absorb ex-service men, it was only right that he should say how well and how loyally the Electrical Trade Union had acted. Moreover, these men had shown themselves to be well advanced in technical knowledge. Mr. Howley had represented the association on that committee, and had done good work for three years. Sir James then expressed satisfaction that Sir Arthur Stanley had again accepted the presidency, after Lord Chilston's retirement. Sir Arthur and his colleagues had been busy in establishing a Whitley Council, and one of its first duties was to ask a Government department for emergency legislation for tramway undertakings. As an association they had every reason to be proud of the Ministry of Transport, which received a tramways deputation from the Whitley Council, promised to introduce legislation, and did so by placing on the statute book the Tramways (Temporary Increase of Charges) Act. Although that Act only recently came into force, there were already some useful Orders made under it, for which tramwaymen should be grateful to Sir E. Geddes and his staff. The association used to speak well of the Board of Trade, but they could now say better things of the Ministry of Transport. Sir James then carried his audience back to thirteen years ago, when Sir Arthur Stanley joined the association. It was then in the Slough of Despond, and the quarter's rent was in jeopardy. The late Mr. Courtenay lent them an office, and there was also a loan of £50 from Mr. Courtenay. He mentioned this to show the state the association was in when Sir Arthur Stanley joined and compare it with present conditions. Sir Arthur always refused to look on the black side of things; his cheerfulness had been a great inspiration, and when he was in the House of Commons he always rendered able assistance to the association and its work. Lord Chilston had served as president for six years; his health was not now good, but he would still retain office.

Sir Arthur Stanley, responding, thanked Mr. Howley for the good work he had done for three years as chairman, and expressed appreciation of Lord Chilston's six years' work as president.

Viscount Chilston also replied. His years of presidency formed a memorable period, and he thanked all the gentlemen on the Council who had assisted him, especially Sir Arthur Stanley and Mr. Secretary de Turckheim, who constantly kept him in touch with association matters. He had really only been Sir Arthur Stanley's deputy, and he was glad Sir Arthur could again resume duty as president. As a vice-president he hoped to have the privilege of maintaining a lively interest in the association.

The toast of "The Chairman" was proposed by Mr. R. J. Howley, C.B.E. He referred to the magnificent work in connection with the Red Cross organisation which Sir Arthur Stanley had been engaged in, and remarked that as Sir Arthur and their own association were so closely connected every member felt interested in Sir Arthur's war work.

In reply, the Chairman said he was touched and flattered by all the kind things that had been said about him, and concluded by asking the company to drink to the health of the secretary, Mr. de Turckheim, who briefly returned thanks.

THE FALK JOINT AT NORWICH.

At a meeting of the Eastern District of the Institution of Municipal and County Engineers held at Norwich, Mr. A. E. Collins, city engineer of Norwich, referred to the use of the Falk joint, appliances for the making of which were shown to the members. Mr. Collins said that the joints had been in continual use in Norwich since the tramways were constructed some twenty-two years ago, and there had been very few cases of breakages. He gave the following description of the work.

The joint consists of a mass of special grade of iron cast around the adjacent ends of the two rails, which are kept as tightly together as possible previous to the casting. The iron is melted in a portable cupola situated in the street close to where the jointing is to be done. Where possible several joints are arranged for at the same time so as to make it worth while lighting up the cupola. The joint mould consists of a pair of castings forming a flask, which is gripped to the rails and further supported with sand outside to prevent the escape of molten metal through the joints of the two halves of the flasks and the rails.

In the joints made over twenty years ago the cast metal was carried to the top of the rail, but it was later thought advantageous to stop it off at a lower level; this has now been abandoned and the previous method reverted to. A heavy iron bar is cramped to the tops of the rails to hold them in alignment and to help to dissipate heat. Before the joint moulds are fixed, the ends of the rails are cleaned or sand-blasted to expose clean metal. There are holes in the webs and bases of the rails near the ends through which the cast metal runs. Copper bonds are not used excepting in occasional cross-bond from one rail to another. At each joint a piece of flat bar forming a vertical staple below the rails is cast welded simultaneously with the joint. This staple is embedded in the concrete for holding-down purposes.

Most of the rails in Norwich weigh 65 lbs. to the yard. Re-laying has been done with 90 lb. rails and 95 lb. rails on curves. The

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65 lb. rails have proved quite satisfactory, but it was felt that better running would be obtained with 90 lb. rails, and consequently the change is being made in renewing the track. There are miles of the 65 lb. rails which were laid at the latter end of last century still satisfactorily in use.

REGIONAL POWER DEVELOPMENT AND LOW TEMPERATURE DISTILLATION OF COAL.

This is the title of an article presented to the American Institute of Electrical Engineers by Mr. C. M. Garland, consulting engineer, Chicago. In view of the recent reports by Parliamentary Committees in this country in favour of the development of the national scheme of electricity supply and the beginnings of the development in that direction through the Electricity (Supply) Act which was passed last session, the views of Mr. Garland in regard to the conditions for such schemes in the United States are of considerable interest. The word regional as used by him refers to a very large territory or region, as distinct from smaller districts, which in the past have constituted areas of electricity supply. The following is an abstract.

Mr. Garland at the outset refers to the fact that more or less practical and comprehensive schemes have been suggested for the development of regional power plants for the industrial districts. The latest of these suggestions, he says, is that presented by Mr. W. S. Murray, proposing a regional power development scheme to include the North Atlantic States.

In the generation of power the avoidable waste of fuel alone in the United States easily reaches the value of 1,500,000 dollars a day, to which may be added the loss through the lack of continuity of service, decrease in production, and the loss through the purchase and maintenance of spare equipment. Combine the savings which can be effected in public utility and industrial plants, without even attempting larger scale methods of generation and distribution, with the saving that can be effected through these methods, and the total savings will amount to more than 3,000,000 dollars a day. The inefficiency in the industrial and also in most of the public utility plants is due to the poor design of the plant, to poor load factor, and to poor operation. There is not one small or medium size plant in a hundred that is designed so that it can be operated efficiently, or if it is so designed, is actually so operated. Mr. Murray's proposal would certainly ameliorate some of these conditions.

Mr. Garland is convinced, however, that no regional power development scheme north of the Mason and Dixon line which contemplates the generation of power from coal is complete unless it provides heat for industrial plants in winter, and furthermore, that no regional power development scheme contemplating the generation of power from bituminous or semi-bituminous coal is more than half-way complete if it does not contemplate the recovery of the by-products from the coal.

In the central and northern portions of the United States every industrial plant for from seven to eight months out of the year require fuel for heating. In 75 per cent. of these plants the fuel required for heating is more than sufficient to generate the power needed for manufacturing operations. For practical purposes it may therefore be considered that the power is obtained during these months without fuel expenditure. This explains why only 30 per cent. of the industrial plants buy their power. The writer is a strong advocate of central station development, but believes that it is well to recognise the limitations imposed by existing conditions. The great barrier to Mr. Murray's project is the fact that the average plant can take advantage of the increased economy of the central station only for four or five months out of the year. During the winter season the same amount of coal would have to be hauled to furnish heating in so far as the industrial plants are concerned. The amount of coal hauled would therefore be reduced only by the amount of coal saved by the electrification of the railroads, which in this section would not amount to more than 20 per cent. of the total. The writer, therefore, cannot see any great relief to railroad congestion unless some method of heating other than direct coal firing is resorted to. It is quite certain that any regional power development that does not include also the distribution of heat will be extremely limited in its success, for with the present methods of electrical power generation it would never be possible to distribute electrical current for the heating of large areas at low temperatures.

The development of the electrical end of the power station, that end which is the most spectacular and appealing to the imagination of the public, has been rapid. The steam and the fuel burning ends of the power plant have lagged behind. There has been no real development in the generation of steam or the burning of fuel in the past 40 years. So it is with the recovery of the by-products from coal. The amount of the by-products, the chemical composition and the methods of recovery have been known for years. Yet, the amount of by-products recovered from fuel burnt for the production of power is insignificant.

In the United States where at least 500,000,000 tons of bituminous coal are burnt annually, there are 10,000,000,000 gallons of tar and the equivalent of 30,000,000,000 pounds of ammonium sulphate, having a combined value of $2,500,000,000 burnt up with the coal. It is not practicable to save all of these by-products, but a recovery of 25 per cent. could reasonably be expected.

The remarkable part of all of this is that the means are at hand to-day and have been at hand for a number of years, for carrying out the regional power development, the regional distribution of heat, the placing of every industrial load on the central station, the relieving of railroad congestion, particularly terminal congestion, through the reduction of the hauling of fuel, the reduction of the smoke nuisance in cities, and in addition to these, the recovery of the by-products from at least 25 per cent. of the coal mined.

In the Mond process, coal is gasified in a special producer whereby the coal is converted into gas, tar, and ammonia. The ammonia is recovered in the form of ammonium sulphate, which amounts to from 50 to 100 pounds per ton of coal gasified and has a value of about four cents per pound under present prices. The value of this by-product therefore varies from $2 to $4 per ton of coal gasified, depending upon the amount recovered. The tar recovered from the straight Mond process represents about 6 per cent. of the weight of the coal, and this tar consists principally of pitch which has little or no value.

The gas from the Mond process has a calorific value in the neighbourhood of 140 B. T. U. per cubic foot and from 65 to 70 cubic feet of gas are obtained per pound of coal. This gas can be burnt under boilers with greater efficiency than the coal and without smoke. It is also suitable for use in the firing of house heating boilers and for small or large industrial furnaces.

This gas can be piped economically within a radius of 15 miles of the central station. This distance limits the size of the central station and to a certain degree, does not accomplish everything that could be desired from regional power and heat distribution. It does, however, relieve railroad terminal congestion and it will in a large measure relieve main line congestion, due to the greater economy in the use of fuel and to the elimination of fuel hauled for the use of railroads.

The Mond process has been in use a great many years in Europe. At South Staffordshire, England, a plant has been in operation for a number of years which distributes gas and power to an industrial district of approximately 123 square miles.

By the low temperature distillation of coal is meant distillation of coal at a temperature around 1,000 deg. Fahr. When distilling coals at this temperature, a very small amount of gas is generated of high calorific value and a large amount of tar with a small amount of ammonia.

This is a process which has been experimented with for years, and which has been demonstrated on a practical scale by different investigators in this country and abroad. It has been definitely determined beyond question of a doubt that from 20 to 30 gallons of tar can be obtained from a ton of bituminous coal, something like 12 pounds of ammonium sulphate and from 1 to 2 cubic feet of gas and about 75 per cent. of coke.

The tar from this process contains considerable quantities of motor fuel and creosotes. It has been estimated that it would be possible by the splitting up of this tar to obtain from 15 to 20 gallons of motor fuel per ton of coal. Investigations indicate that in a crude state this tar is worth in the neighbourhood of 10 cents a gallon.

The coke from this process would probably contain in the neighbourhood of from 12 per cent. to 15 per cent. of volatile matter which would contain most of the nitrogen originally in the coal. By gasifying this coke in the by-product gas producer, from 50 to 85 pounds of ammonium sulphate will be obtained per ton of coke gasified and from 65 to 70 cubic feet of gas having a calorific value in the neighbourhood of 140 B. T. U.

The low temperature process will yield by-products having a value of from $2 to $3 per ton of coal gasified. By gasifying the coke in the by-product gas producer the ammonia recovered will have a value of from $2 to $4 per ton of coal gasified, depending upon the amount recovered. In other words, by combining these two processes, by-products having a value of from $4 to $7 per ton of coal gasified may be obtained.

A combination of the two processes will result in a mixed gas having a calorific value of about 150 B. T. U. per cubic foot. There are other advantages in the combination of the processes such as the simplification of the scrubbing of the producer gas due to the fact that 95 per cent. of the tar comes off in the low temperature distillation.

The market for the by-products obtained from these two processes is an ever increasing market which insures either a constant price or a constantly increasing price. In this combination of the low temperature process with the Mond gas producer lies the greatest development in the power field to-day and it is a development requiring practically no experimentation.

Mr. Garland would ask Congress for an appropriation of $5,000,000 for the construction of a workable sized plant along the lines of the combined Mond and low temperature distillation processes. This $5,000,000 properly used would, he maintains, bring greater returns to the American people than any money Congress ever spent.

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FINANCIAL REPORTS AND MEETINGS.

J. G. White and Company, Limited.—A dividend of 7 per cent. less tax, has been declared on the ordinary shares for the year ended February 28 last. A sum of £30,000 is carried to reserve and £15,286 is carried forward.

Subsidies to London Companies.—Sir Eric Geddes stated in the House of Commons on June 14 that the Government had granted no direct subsidies to the London General Omnibus Company or to the London tube railways.

Adelaide Tramway Trust.—The accounts of the Adelaide Tramway Trust for the half-year ended January 31 last, as given by the *Commonwealth Engineer*, shows that the total receipts amounted to £242,895, as compared with £218,550 for the corresponding period in the previous year. The revenue per car mile on the Adelaide section was 22·259d., and the expenses 17·770d., giving a percentage of operating expenses to revenue of 66·080. On the Port Adelaide section the corresponding figures were 18·305d., 13·408d., and 73·253 per cent. After deducting all expenses there was a balance of £3,555.

Dundee Tramways.—It appears that the Dundee tramways department will be faced with a serious deficit, the first since the tramway system was taken over by the Corporation. The revenue is stated to be not sufficient to meet the expenditure, and during the past six months more than £10,000 of a special ear-marked fund has been absorbed. Some time ago the "penny all-the-way" fare from the centre of the city to any of the termini was introduced. Later the fares were doubled, but there is still a deficit on operation. It is expected that the 1d. fares will either have to be abolished or distances shortened and other increases made.

Exeter Corporation Tramways.—In his annual report the manager (Mr. R. O. Baldwin) states that the system attained a record in the number of passengers carried during the past year. The passengers numbered 5,986,594, an increase of 390,214 on the previous year. Traffic receipts were £31,336, an increase of £8,703 on the previous year's record, and the largest in the history of the undertaking. Total receipts were £31,606, and total working expenses, exclusive of capital charges, were £28,443, as against £16,516. Of the increase £5,700 was due to wages, and the item for car repairs showed an increase of £3,000. Car miles run totalled 397,511, an increase of 53,406.

British Electric Traction Company.—The net profit for the year ended March 31 was £211,316, a decrease of £2,008. The directors recommend placing to reserve £8,025, a dividend of 6 per cent. for the year upon the cumulative participating preference stock, £42,765 (on account of which £21,382 has already been paid), and 4 per cent. for the year upon the ordinary stock, £53,050, carrying forward £150,422, against £130,952 brought in. While the receipts of the associated companies have continued to increase, the effect is more than offset by the increased cost of operation. The investments are now £4,027,792 and yield an average of 5·28 per cent., as compared with 5·08 per cent. for the preceding year.

Leeds Tramway Finance.—At a meeting of the Leeds Tramways Committee on June 21, Alderman R. A. Smithson presiding, the result was announced of the working of the tramways from the beginning of the financial year (April 1) to June 2, when the fares were increased. The particulars, which are given below, show that there was a deficit on the working for this period of £16,277, or £258 per day. Since the fares were increased at the beginning of the present month the total number of passengers has increased by 1 per cent. The increase has been mainly in 1d. fares, and there has been a corresponding decrease in the 1½d. and 2d. fares.

Leeds Tramway Traffic Receipts.—The regular weekly publication of the traffic return of the Leeds Corporation tramways has been suspended for some months because of the opinion of the Tramways Committee that such publication unaccompanied by a statement in the rapid increase in costs might be misunderstood by the ratepayers and the travelling public. In the meantime the general manager (Mr. J. B. Hamilton) has been instructed to issue a monthly statement of the total revenue, accompanied by an approximate statement of the total actual costs of operation. The first publication of a return under this arrangement covers the period from April 1 to June 2 inclusive. This period was selected as it coincided with the fares which had been in operation for about two years, a change taking place on June 3. The return is as follows :—

	Per Car-mile.	April 1–June 1, 1920.	April 1–June 1, 1919.
Traffic and sundry revenue	21·66d.	£161,144	£154,659
Expenditure	23·85d.	£177,421	—
Deficit	2·19d.	£16,277	—

The number of car-miles run was 1,785,767.

GLASGOW CORPORATION TRAMWAYS.

In our issue of June 10, some traffic and other statistics of the Glasgow Corporation Tramways for the year ended May 31 were given. The following is a summary of the accounts for that year compared with those of earlier years, including 1913 :—

Year ended May 31	1920.	1919.	1917.	1915.	1913.
	£	£	£	£	£
Traffic receipts	1,716,491	1,527,488	1,245,507	1,070,694	1,007,653
Sundry receipts	5,087	3,832	14,607	6,183	3,891
Total revenue	1,721,578	1,531,320	1,260,114	1,076,877	1,011,544
Traffic expenses	856,111	674,664	395,736	345,625	305,400
General expenses	225,872	174,508	137,816	142,020	122,812
Maintenance and repairs ...	317,521	219,509	143,758	144,530	142,988
Power expenses	152,742	106,686	67,231	51,995	48,147
Clydebank bridges	2,314	1,753	879	....	—
	1,554,560	1,177,120	745,420	684,170	619,347
European War	3,601	72,869	92,645	51,817	—
Total expenditure ...	1,558,161	1,249,989	838,065	735,987	619,347
To net revenue account ...	163,417	281,331	422,049	340,890	392,197
Dumbarton tramways ...	—	—	—	126	180
Interests on investments ...	13,345	10,565	78,637	65,701	58,451
Total	176,762	291,896	500,686	406,717	450,828
Deductions—					
Rent of Paisley lines ...	11,093	9,755	8,453	5,559	8,844
Interest on capital ...	3,892	—	78,846	78,797	81,774
Sinking fund	1,715	—	114,378	105,493	97,077
Income-tax	81,295	83,702	64,622	22,789	13,388
Parliamentary expenses ...	1,056	124	98	8,818	985
Renewal and depreciation	186,242	183,543	73,305	172,310	215,757
Total	285,293	277,124	339,702	393,766	417,825
Surplus to common good ...	—	14,772	160,984	12,951	33,003
Deficit	108,531	—	—	—	—

The result for the year 1919-20 is a deficit of £108,531, the first in the history of the undertaking. As the tramway department has now only a small debt, the interest and sinking fund charges are comparatively light.

MANCHESTER CORPORATION TRAMWAYS.

The following is a summary of the Manchester tramway results for the year ended March 31, 1920, compared with the four preceding years :—

Year ended March 31	1920.	1919.	1918.	1917.	1916.
	£	£	£	£	£
Traffic revenue ...	1,575,687	1,359,391	1,108,165	965,829	925,301
Miscellaneous	9,907	9,774	9,811	9,809	9,680
Motor omnibuses ...	—	210	1,563	158	1,083
Parcels	1,269	234	323	2,881	3,405
Total	1,586,863	1,369,609	1,119,862	978,677	939,469
Traffic expenses ...	653,683	295,541	282,550	275,283	261,689
General expenses ...	135,221	98,249	89,615	89,823	88,053
Repairs and maintenance	241,184	133,091	109,155	96,114	81,755
Power expenses ...	177,142	154,521	148,899	137,524	129,942
War service allowances	—	287,988	156,936	91,023	92,808
Total expenditure	1,207,230	969,390	787,155	689,767	654,247
Balance to net revenue	379,633	400,219	332,707	288,910	285,222
Add—Interest ...	18,862	17,861	15,372	—	14,518
Leaving a sum available of	398,495	418,080	348,079	—	299,740
Deduct—					
Interest on capital ...	67,175	65,652	64,124	—	59,737
Redemption of debt	69,392	67,357	65,335	—	61,236
Street Improvements					
Interest and Sinking Fund	6,485	6,224	5,983	—	6,128
Rent of tramways ...	26,911	27,951	28,069	—	26,773
Leaseholds—					
Proportion of outlay	385	469	509	—	684
Income-tax	—	—	—	—	24,001
Motor omnibuses ...	310	—	—	—	—
	170,658	167,653	164,020	—	178,559
Balance	227,837	250,428	184,059	—	121,181
Appropriated—					
Renewals	80,229	110,597	73,228	—	21,181
Income-tax	35,717	27,940	10,831	—	—
Contribution to rates	111,891	111,891	100,000	—	100,000
	£227,837	£250,428	£184,059	—	£121,181
Car mileage	18,906,654	18,146,551	18,540,585	—	18,486,440
Total number of units	32,402,628	29,655,831	30,193,911	—	28,713,922
Units per car-mile ...	1·714	1·634	1·628	—	1·553
Average cost per unit	1·312d.	1·251d.	1·183d.	—	1·086d.
Percentage of expenses to receipts	76·1%	70·8%	72·7%	—	59·76%
Traffic revenue per car-mile	20·002d.	17·979d.	14·345d.	—	12·013d.
Traffic revenue per mile of single track ...	£8,078	£7,022	£6,146	—	£5,032
Total revenue per car-mile	20·127d.	18·114d.	14·496d.	—	12·197d.
Total working expenses per car-mile ...	15·325d.	12·821d.	10·189d.	—	7·289d.
Average fare per passenger...	1·342d.	1·294d.	1·116d.	—	1·06d.
Passengers carried ...	285,046,914	253,940,203	240,914,369	—	209,877,667

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PERSONAL.

Mr. E. Morgan has been appointed assistant electrical engineer of the Wolverhampton Corporation, at a salary of £500 per annum.

Mr. J. R. Walker, assistant power station engineer, has been appointed inspecting engineer in the tramways department of the London County Council.

Mr. W. Grant, general manager of Ayr Corporation tramways, has been granted a bonus of £135, and Mr. R. Marshall, the electrical engineer, a bonus of £150.

Mr. W. S. Wreathall has been appointed chairman of the Wrexham and District Transport Company, Limited, in place of Mr. J. V. Kitchener, who has resigned.

Mr. A. S. Hooppell, late junior assistant engineer of Southend Corporation electricity station, has been appointed charge engineer at the Torquay Corporation electricity works.

Mr. C. H. Wordingham, C.B.E., M.I.C.E., in order to deal more conveniently with his consulting work in the Lancashire district, has opened offices at 11, Mosley Street, Manchester.

Mr. Emile Garcke at the meeting of the British Electric Traction Company announced his resignation of the chairmanship of the company. He will remain a member of the board.

Mr. W. Forbes, general manager of Aberdeen Corporation tramways, has been granted an increase in salary to bring it to the level of that of other Corporation officials in the same rank.

Mr. F. Dudley Docker has resigned the chairmanship of the Metropolitan Carriage, Wagon and Finance Company, Limited. **Sir Ernest Hiley,** deputy chairman, has succeeded him.

Mr. R. M'Leod, at present chief clerk of Edinburgh Corporation tramways, has been promoted to the post of traffic superintendent, in place of Mr. W. P. Young, who has been appointed manager of Dundee City tramways.

Mr. J. H. Menzies, depot superintendent of the Dundee tramways, has been appointed general manager of Kilmarnock Corporation tramways. Mr. Menzies was employed on the staff of the Glasgow Corporation tramways, and subsequently on the Lanarkshire tramways, afterwards returning to the Glasgow tramways. In 1905 he was appointed depot superintendent at Dundee.

Mr. T. G. Richardson, manager of the Colne Corporation Light Railways, has been appointed general manager of the West Hartlepool Corporation Tramways and Omnibus undertaking, at a salary of £600 per annum. Mr. Richardson has been engaged in tramway work for twenty years, the first thirteen being spent with the Bradford City Tramways and the remaining period as general manager and engineer to the Colne Corporation Light Railways.

Mr. Walter P. Young.—On the occasion of his leaving the Edinburgh Corporation tramways in order to take up his duties as general manager of the Dundee city tramways, Mr. Young has been presented by the officials and staff of the department with a handsome silver-plated reading lamp and umbrella. Mr. Pilcher, who made the presentation, while commenting upon Mr. Young's short stay in Edinburgh, not only congratulated the latter personally on the change into management which he was about to make, but also the Corporation of Dundee in securing the services of such an energetic and genial man as Mr. Young.

Mr. R. O. Baldwin, general manager of the Exeter Corporation tramways, has been granted an increase in salary to £400 per annum as from April 1, 1920, and to £450 per annum as from April 1, 1921. Mr. C. Yendell, in recommending the increase, said that the undertaking was in a healthier state than for many years. Mr. F. G. Towill, chairman of the Tramways Committee, said that the annual report was really a splendid one under the circumstances. The manager had had an uphill task, but the system was in a creditable position. The manager had the foresight to lay in a large stock of supplies, which were worth considerably more now than when they were bought.

Mr. R. L. Horsfield, who has taken up his new position as general manager of Cardiff Corporation tramways, has been presented by the staff of Walsall Corporation tramways with an oak bureau bookcase with a small brass plate bearing a suitable inscription. The presentation was made at a midnight gathering on Saturday in the large omnibus garage, which had been effectively decorated. The mayor, Councillor H. H. Tucker, occupied the chair, and other members of the Town Council were present, including Alderman J. Cope, chairman of the Tramways Committee, and Alderman J. Williams, vice-chairman. Mr. Charles Burgess, general manager of West Hartlepool tramways, who succeeds Mr. Horsfield at Walsall, was also present. The mayor paid a high tribute to the work and character of Mr. Horsfield, and Alderman J. Cope spoke in eulogistic terms of his ability and devotion to the success of the undertaking. Other speakers included Mr. J. Smith, president of the local branch of the Vehicle Workers' Union.

PRESENTATION TO MR. C. W. MALLINS.

On the occasion of a presentation to Mr. C. W. Mallins to mark his retirement from the general managership of the Liverpool Corporation Tramways, a luncheon was given to the members of the tramways committee and others by Councillor F. C. Wilson, the chairman of the tramways committee. The gift comprised a silver rose bowl, salver and vases, bearing appropriate inscriptions.

The chairman briefly outlined Mr. Mallins's 46 years' connection with the city's tramways, during which period the undertaking had grown from a minor service to an important undertaking carrying over 210,000,000 passengers per annum. He referred to the zealous manner in which Mr. Mallins had carried out his duties, and the exceedingly hard way in which he had worked for the Corporation and citizens. There was no public servant, he said, who had laboured harder or more continuously or with greater devotion and energy than Mr. Mallins, and his work as tramways manager had proved of great benefit to the public. Sincere regret was felt that, owing to ill-health, he had found it necessary to retire from active service.

Alderman Fred. Smith spoke of his long association with the tramways committee and of his knowledge of the ability shewn by Mr. Mallins.

Alderman Russell-Taylor referred to his five years' chairmanship of the tramways committee, during which time, he said, he had learned to appreciate how much the citizens owed to the ability, hard work, and foresight of Mr. Mallins.

Mr. Mallins suitably acknowledged the gifts, and thanked the committee for the whole-hearted support always extended to him during the whole course of his career. That support had often helped him to overcome the many difficulties that beset the path of a tramway manager. He briefly outlined the development of the tramways undertaking, and said that when he joined the service in 1874 there were only 18 cars running in Liverpool. Referring to the periodic changes in the types of vehicles used for passenger transport, he remarked that the horse cars supplanted the omnibuses, the electric cars had then taken the place of the horse cars, and many people now considered that tramcars were becoming obsolete, and that other types of vehicle should be adopted. He considered that in the future the various passenger transport systems of the city should be co-ordinated.

Letters of regret for absence were read from Sir Archibald Salvidge, Sir Charles Petrie (for many years chairman of the committee), Councillors Metcalfe, P. J. Kelly, L. D. Holt, P. D. Holt, and T. O. Ruddin; Mr. Priestly, the general manager of the tramways, who was on Parliamentary business in London; Mr. Brodie, city engineer, who was attending the conference of municipal engineers in Dundee; and Mr. Barrow, city treasurer and controller, who was attending a conference at the Ministry of Health.

BUSINESS NOTICES.

Dennis Brothers, Limited, Guildford, inform us that they can now guarantee immediate delivery of the Dennis 3-4 ton lorry.

The J. G. Brill Company have removed their offices from 110, Cannon Street, London, E.C., to 150, Southampton Row, W.C.1. (Telephone, Museum 5313.)

Half-Watt Type Electric Lamps.—Members of the Electric Lamp Manufacturers' Association, including the Edison Swan Electric Lamp Company, Ponders End, the British Thomson-Houston Company, Rugby, the General Electric Company, 67, Queen Victoria Street, and others, have placed on the market half-watt type lamps of 60-watt consumption at 200-250 volts and 40 watt-consumption at 100-130 volts.

Mr. Thomas W. How, managing director of the Empire Roller Bearings Company, Limited, writes to us to say that they would be willing to give the benefit of their experience and designs to competitors for the prize of £1,000 for the best design of an electric tramcar offered by the London County Council, who may care to suggest in their plans the use of roller bearings axle boxes as an alternative to the plain bearings at present in use on the standard cars of the London County Council.

Woods-Gilbert Rail Remodelling Company, Limited.—As additional capital is required by this company for the construction of more machines to cope with the contracts and to develop the electric welding part of the process, it is proposed to increase the capital from £30,000 to £60,000. The shareholders have accordingly passed the following resolution:—"That the capital of the company be increased to £60,000 by the creation of 22,500 10 per cent. cumulative participating preference shares of £1 each, 5,000 10 per cent. non-cumulative participating preference shares of £1 each, and 2,500 ordinary shares of £1 each, and that each class of shares shall rank *pari passu* (both as regards dividend and capital) with the shares of the same class already issued."

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TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.

NEW ROLLING STOCK.

At a recent meeting of the Aberdeen Town Council the manager presented a report recommending the addition of thirty new cars, with the necessary shed accommodation. The entire cost was estimated at £90,000. After a long discussion it was decided to purchase six new cars at a cost of £2,050 each.

BLACKPOOL.

TRACK RENEWAL—TRAMWAY PASSES.

The Blackpool Tramways Committee has decided to re-lay the Marton tramway, and the work will be put in hand at the beginning of October. The borough surveyor's estimate for the re-laying of all the tramway tracks in the borough is £254,000. At a recent meeting of the Town Council the Finance Committee were asked to pay an account for £86 2s. 5d. for the supply of red tramway passes. The committee, after paying the account, resolved that the Tramways and Electricity Committee be recommended to instruct the tramways manager to furnish each member of the Council with a list of persons to whom the 350 red tramway passes were issued. The recommendation was approved by the Town Council.

BOURNEMOUTH.

ARBITRATION ON CLAIMS OF WORKERS ON TRACK RECONSTRUCTION.

The strike of labourers engaged in the reconstruction of Bournemouth Corporation tramway track was terminated on June 3, when it was agreed that the question at issue as between the Corporation and Messrs. Griffiths, the contractors, and the men should be decided by arbitration. The strike commenced on May 8, when the labourers were receiving 1s. 2½d. per hour. They claimed a rate of 1s. 9d. Subsequently an offer of 1s. 4d. for ordinary labourers and 1s. 5d. for hammermen was made, but this offer was rejected.

BURTON-ON-TRENT.

STRIKE AVOIDED BY CONCESSION—EMPLOYEES' WAGES AND FARES.

The threatened strike of the Burton-on-Trent Corporation tramway employees was averted by a grant of ½d. per hour on their basic rates as from March 29, 1920. The men will thus receive an increase of 42s. per week over pre-war rates. The maximum rates will be—Motormen, £3 12s. 3d.; conductors and cleaners, £3 8s. and labourers £3 6s. 3d. The increase was in accordance with the recommendation unanimously adopted at the meeting of the District Industrial Council held at Birmingham on March 27. The tramways committee propose to raise the minimum fare from 1½d. to 2d., other fares being raised by ½d., with the exception of the present maximum fare of 3d. Children's and workmen's 1d. fares will remain unaltered.

CARDIFF.

MANAGER'S PROPOSAL FOR NEW ROLLING STOCK ADOPTED.

Reporting upon the condition of the rolling stock to the Cardiff Tramways Committee, the general manager (Mr. R. L. Horsfield) stated that there are 129 passenger cars, of which on an average 30 are out of commission. He suggested that tenders be invited for ten bogie trucks, together with the electrical equipment, which could be used with some of the present bodies. The estimated cost would be between £12,000 and £14,000, and delivery might be obtained within four or five months. This would enable the department to put at least twenty more cars in service by the end of the year. The committee adopted the proposal, and Mr. Horsfield was also instructed to confer with the city engineer on the question of extending the Clare Road tramway depot.

EDINBURGH.

CHARS-A-BANCS—PARCEL DELIVERY—RAILS REMOVED.

The Town Council has received a letter granting the Corporation permission to run motor chars-a-bancs through Holyrood Park, on the Corporation undertaking to pay £50 towards the cost of the additional maintenance of the roads. The tramways manager (Mr. R. S. Pilcher) reported that twenty-four regular boy messengers were employed in the tramway parcels service. The boys worked a maximum of eight hours per day, with a half-holiday per week, their wages being 15s. per week. A delivery van had, however, been acquired, and it was proposed to do a considerable part of the work by this means. The tramway rails are to be removed from Morrison Street. It is estimated that there will be 94 tons of rails in good condition, and these will be available for use elsewhere.

EXETER

COUNCIL INSPECT TRAMWAY WORKS.

Members of the Exeter City Council recently inspected the tramway depot and shops, and were shown some new acquisitions, including tire-shrinking apparatus and machines for pressing wheels on and off axles, etc. Mr. R. O. Baldwin, the tramways manager, who conducted the party over the depot, said that three cars had recently been rebuilt in the works, and others were being dismantled preparatory to reconstruction. Mr. C. Yendell, in proposing a vote of thanks to the chairman and members of the tramways committee, for the invitation to inspect the depot, said that they often heard criticisms of matters about which they knew little, and he felt that that afternoon had been an instructive one for them. He was sure they would all better appreciate the work of the tramways committee and the manager. Mr. A. S. Seaton, in seconding, said that they had every confidence in the undertaking, which was just coming out of stormy weather. Out of thirty-six such undertakings in the United Kingdom there were only three others whose working expenses per mile were less. In replying, the chairman said that out of eighty-four undertakings in the United Kingdom, Exeter was one of ten which were now paying their way.

HULL.

NEW TOP COVERS.

Hull Corporation Tramways Committee, after inspecting a form of top cover, approved the design. The cover extends over the entire length of the car so that all seats are enclosed as well as the steps leading to the top of the car. This provides space for eight more seats The route figures inside the glass cover are silhouetted by the reflection of the light from the car.

LEEDS.

NEW TRAMWAY TO HOUSING SITE.

The general manager of the Leeds Corporation Tramways (Mr. J. B. Hamilton) has been instructed to report on the preliminary steps to be taken with regard to the construction of the proposed tramway to connect the newly added township of Middleton with the city. On the western boundary of the new suburb is the site of a new housing scheme. The line will be about 3½ miles in length, and in certain portions will be constructed on private property and will be in the nature of a light railway. The construction of the new line will entail much engineering work, and when completed it will open out some of the prettiest woodland scenery in Leeds.

LEICESTER.

WAGES OF TRAMWAY EMPLOYEES.

Traffic inspectors of the Leicester Corporation Tramways are now receiving £4 3s. per week, ticket inspectors £4 0s. 6d., motormen £3 15s. 8d., and conductors £3 13s. 5d.

LIVERPOOL.

CHARGE FOR CURRENT INCREASED.

Liverpool Corporation has increased the basic charge of 1d. per unit for electrical energy supplied to the tramway undertaking by 15 per cent. as from June 30, and a variation for fuel price adjustment is to be added to the increased charges.

NEWCASTLE.

TRAMWAYMEN'S HOLIDAYS.

The Newcastle City Council, on June 2, received a deputation of tramwaymen who asked for twelve days' holiday per annum with full pay. The spokesman said they had been offered eight days under the national agreement, but they considered they should have the same privilege as the men on the city engineer's staff and the cleansing staff, who had twelve days' holiday with full pay. In the case of other Corporation workmen their holidays were charged on the rates, and as ratepayers the tramwaymen helped to pay for them. If the privilege were granted them, however, it would not, the speaker said, be a charge on the rates. The question was referred to the tramways committee.

OLDHAM.

INCREASE IN ROLLING STOCK.

Mr. W Chamberlain, general manager of Oldham Corporation Tramways, has reported to the tramways committee that twelve trucks and two complete bodies have been delivered, and he hoped to have two new cars in service shortly.

PLYMOUTH.

LOANS GRANTED FOR NEW TRAMWAY CARS AND OMNIBUSES.

At Plymouth Tramways Committee the Town Clerk reported that the following sanctions had been received from the Ministry of Transport to borrow the undermentioned sums—£5,000 in respect of machinery and plant (term for repayment, 30 years); £28,000, purchase price of fourteen new tramcars (term for repayment, 15 years); £30,000, purchase price of twenty motor omnibuses (term for repayment, eight years).

SOUTHAMPTON.

EMPLOYEES TO ASSIST IN ARRANGING DUTIES.

As the employees of the Southampton Corporation Tramways took exception to a new list of running times and duties, Mr. James Dobson, general manager and engineer, invited a deputation to meet him. After a conference lasting several hours, arrangements were agreed upon between the manager and the men's representatives whereby a committee of the employees are to assist the management in drawing up a list of duties which, while meeting the requirements of the public, will be acceptable to the drivers and conductors.

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STIRLING.

STIRLING AND BRIDGE OF ALLAN TRAMWAYS CEASE BUSINESS.

Stirling and Bridge of Allan Tramways Company, which was established in 1873, ceased business on May 26. Some months ago the company discontinued their horse tramway service, which had been in operation for forty-five years, and replaced the horse cars by motor omnibuses. There was, however, keen competition, and the company have disposed of their omnibuses, car sheds, and other buildings at Causeway Head to the Scottish General Omnibus Company. A description of the undertaking of the latter company was published in our issue of April 15, 1920. The tramway rails between Bridge of Allan, Stirling, and St. Ninans, which remain the property of the company, will be removed.

WALTHAMSTOW.

FINE FOR LEAVING CAR BY DRIVER'S PLATFORM.

Two passengers were summoned at Walthamstow for leaving the tramway car other than by the conductor's platform, and were fined ten shillings each. The manager, who prosecuted, said that the defendants were travelling on a car on May 9, and as it approached the terminus at Chingford Mount they went down the staircase at the driver's end, and in spite of the motorman's protest jumped off the car before it stopped. This was a dangerous practice, and the Council desired to put an end to it. A boy was also fined 10s. for leaving a Walthamstow car without paying the fare. He was riding on the rear end of the car, which was quite full, and he admitted that he was "having a ride."

WIGAN.

CAR DEPOT FLOODED.

The worst thunderstorm experienced in the Wigan district for many years occurred on June 5. There was much lightning, and very heavy rain fell for nearly two hours. The water from the surrounding land collected at the Corporation tramway sheds at Melvilry Street, Seven Stars Bridge, and the ground was flooded to such a depth that the cars could not be housed, and had to be left outside during the night. On Sunday the water was 18 in. deep over the tramway tracks inside the shed. The fire brigade motor pump was set to work about 9 p.m., and from that time until 10.30 the following morning, when the accumulation of water in the sheds was cleared. It is estimated that in the 24 hours 1,800,000 gallons of water had been pumped.

YORK.

INJURY FROM FALLING TROLLEY WIRE.

On July 2 the trolley wheel of a York Corporation tramway car, when on Queen Street bridge, jumped the trolley wire and broke the guard wire. One man received a slight injury to his face from the falling wire. The current was quickly cut off and repair was at once undertaken, but an hour and twenty minutes elapsed before the service could be resumed.

LONDON COUNTY COUNCIL.

COMPETITION FOR ELECTRIC TRAMCAR DESIGN.

The London County Council invites engineers and others possessing the requisite technical knowledge to submit designs for a new type of electric tramcar for use on its tramways.

The competition will be open to persons of any nationality and whether resident in Great Britain or not. No person in the service of the Council will be eligible to compete.

The designs will be assessed by Mr. A. L. C. Fell, General Manager of the Council's tramways, and an engineer nominated by the President of the Institution of Civil Engineers.

The conditions of competition provide for the award of a prize of £1,000 to the competitor who sends in the design which it is decided by the assessors is the best of those submitted and which complies with such conditions.

The designs, accompanied by the necessary reports, specifications, etc., must be delivered at the competitor's own expense not earlier than November 1, and not later than 4 p.m. on Tuesday, November 30, 1920. Applications for conditions, plans, etc., relating to the competition should be addressed to the General Manager, London County Council Tramways, No. 23, Belvedere Road, London, S.E.1.

Competitors, on payment of a sum of 2 guineas, will be furnished with a general drawing of the type of car at present in general use on the London tramways system, accompanied by the more important particulars relating thereto. This amount will be returned to each competitor who submits a *bona fide* design and does not subsequently withdraw the same, and also any person who, on receipt of the conditions, etc., decides not to compete and returns the copy of the drawing, etc., referred to above, within two weeks.

JAMES BIRD,
Clerk of the London County Council.

CONTRACTS AND ORDERS.

John Baker and Company's tender for car wheels has been accepted by Glasgow Corporation.

A. Wiseman, Limited, of Birmingham, have received an order for gear wheels from Glasgow Corporation.

Pease and Partners, Limited, have an order from Bradford Tramways Committee for 10 tons of C.I. brake blocks at £245.

The English Electric Company's proposal for the extension of the electricity works has been accepted by Burnley Corporation.

Walter Scott, Limited, have received an order from Bradford Tramways Committee for 15 tons of steel fishplates at £32 10s. per ton

Bolckow, Vaughan and Company's tender for 5,000 tons of tramway rails and fastenings has been accepted by the London County Council.

United States Steel Products Company's tender for fish plates for tramway rails has been accepted by the Manchester Tramways Committee.

The British Union Lamp Works, Limited, are to supply metal filament lamps during the year to Salford Tramways Committee at 1s. 8d. each.

The Western Electric Company are carrying out an installation of a traffic control telephoning system for the Plymouth Corporation tramways, the price being £584.

J. W. Courtenay, Limited, of Amberley House, Norfolk Street, London, W.C., have been appointed sole advertising contractors to Lincoln Corporation tramways.

Metropolitan-Vickers Electrical Company are to supply switchgear etc., in connection with the new 12,000 KW. generating set for the Lister Drive power-station of Liverpool Corporation.

Plymouth Corporation Works Committee have accepted the tender from Straker-Squire, Limited, for a motor vacuum gully cleaner at £1,350, and of Thornycroft and Company, for two tipping wagons at £3,159.

Johannesburg Municipal Council have ordered an "Orwell" electric motor tower wagon, including a charging set, at a cost of £2,831. The Council received prices of petrol wagons, but has decided to experiment with an electric vehicle.

Halifax Tramways and Electricity Committee have accepted the following tenders:—Babcock and Wilcox, Limited, cross type marine boilers, £10,710; E. Green and Son, Limited, economisers of 240 tubes, £2,063; Crompton and Company, Limited, three motors, £777, with starting gear, £170.

The Consolidated Construction Company's tender, amounting to £202,275 19s. 9d., for the construction of tramway track work and improvement works along the route from Mare Street to West India Docks has been accepted by the London County Council. The figure for the track work is approximately £176,320.

Glasgow Corporation have recently accepted the following tenders for supplies for twelve months:—B.I. and Helsby Cables, Limited, copper bonds; Manchester Armature Repair Company, Limited, armature coils; Liverpool Electric Cable Company, Limited, 70-20 V.R.I. cable; Frederick Smith and Company, Limited, trolley wire.

Derby Town Council have been recommended to accept the tender of Scholey and Company, Limited, amounting to £12,516, for treating by the "insitu" rail hardening process the tramway rails. Another tender recommended for acceptance is that of the Rail Welding Company, amounting to £1,833, for the electric welding, retreading and grinding joints.

Plymouth Corporation have accepted the following tenders:—Motor vacuum gully cleaner, £1,050, Straker Squire, Limited; two tipping wagons with interchangeable bodies, £3,159, John I. Thornycroft and Company, Limited; one sweeper and loader, £485, Walker and Company; 5,000 gallon petrol tank, £310, Anglo-American Oil Company; tire press, etc., £550, Knott and Sons; power hammer, £383, Alldays and Onions.

Messrs. Scholey and Company, 56, Victoria Street, S.W., contractors and licensees for Messrs. C. P. Sandberg, have secured contracts with the Corporations of Edinburgh and South Shields each for the treatment of two miles of single track by the "Insitu" process, the latter being a repeat order. Messrs. Scholey and Company have up to date obtained orders for the treatment of over 80 miles of track (of which 52 miles are repeat orders) on the tramways of Croydon, Birmingham, Bournemouth, Bristol, Bolton, Derby, Edinburgh, Glasgow, Leeds, Liverpool, London County Council, London Metropolitan, Manchester, Newcastle, Reading, Sheffield and South Shields. Recent gaugings taken with a specially-designed instrument recording to within four thousandths of an inch, show that the wear on the untreated rails is from two and a half to three times that on the rails treated by the "insitu" process.

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PATENT LIST

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Brake operating devices (15,213)—L. Boirault.
Brake adjusting means (14,907)—Brush Electrical Engineering Company and W. E. Hall.
Life guards for motor vehicles (14,888)—E. J. Buckingham.
Welding fishplates on tramway rails (15,219)—C. D. Burnet and E. Jacob.
Anti-skidding and anti-splashing appliances for motor vehicles (14,976)—F. von Eulenfeld.
Tramway and railway vehicles (14,845)—J. Lee, W. Matthews, and E. Spencer.
Combination number-plate and rear lamp for motor vehicles (15,039)—P. Price.
Radiators for motor vehicles (15,805)—J. Beaumont and Sons and A. Sykes.
Overhead trollies for electric tramway, etc., vehicles (15,572)—T. Blaney and D. Williams.
Motor vehicles (15,841)—J. C. Brazier.
Motor vehicles (15,332)—G. A. Broomfield and F. J. Camm.
Registration sign and direction indicator and alarm for mechanically-propelled vehicles (15,387)—C. E. Byard.
Traction devices (15,759)—W. J. Chism.
Device for aligning trolley wheels with overhead transmission wires (15,912)—G. George.
Motor vehicles (15,412)—A. Good.
Anti-splash devices for wheels of motor vehicles (15,811)—T. Grocott.
Devices for lubricating wheel flanges of vehicles running on rails (15,426)—P. Jager.
Car fenders (15,033)—O. G. Jones.
Light goods railway (15,940)—W. Lamb.

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WORKS—IPSWICH

Spring suspension for front axle of motor vehicle (15,507)—Oesterreichische Waffenfabriks Ges.
Rear axle for motor vehicle (15,511)—Oesterreichische Waffenfabriks Ges.
Clutch operating differential gear for motor vehicles (15,539)—A. Walker.
Seat cover for motor omnibuses (16,296)—W. A. Blagg.
Bow current collectors in overhead wire systems of electric traction (16,369)—Brecknell, Munro and Rogers and A. M. Willis.
Rail joint (16,076)—Y. Dedik.
Signalling apparatus for motor vehicles (16,167)—H. Elsworth and H. Hawthorne.
Lifting jacks (16,078)—C. C. and F. G. Hayward.
Trailer for automobiles (16,206)—J. H. Labourdette.
Steering gear for mechanically-propelled vehicles (16,330)—H. Marles and Marles Steering Company.
Rail fastener (16,077)—W. Sanowski.
Radiator for motor vehicles (17,131)—T. Bliss.
Keys for holding down tramway rails in their supporting chairs (17,467)—W. A. Buyers and L. Green.
Life-saving devices for motor vehicles (17,266)—E. Capleton.
Brake and change-speed driving gear for motor vehicles (17,108)—Castle Motor Company and S. Goodwin.
Wood key for rails (17,272)—W. G. Chandler.
Motor vehicles (16,648)—L. Cowlishaw.
Indicators for motor vehicles (17,052)—E. W., G. F. V., and H. A. Daniels, W. Hagger, and Malenta Works.
Motor vehicles (16,902)—F.I.A.T. Soc. Anon.
Life guards for tramcars (16,730)—S. W. Fidler.
Lifting jacks (16,702 and 16,703)—J. Fürst.
Motor vehicles (17,264)—T. Greenwood.
Steering gear of mechanically-propelled vehicles (16,878)—A. G. Grice.
Tramway vehicles (17,389)—P. Kavanagh.
Lifting jack (16,827)—S. A. King (administratrix of *H. A. King*).
Monorail vehicles (17,323)—E. E. Johnson.
Wheels for motor vehicles (17,447)—M. Landrin.
Life guards for vehicle wheels (17,298)—London General Omnibus Company and G. J. Shave.
Gearing for motor cars (16,954)—C. R. McCallum.
Supporting stays for platforms of tramcars (17,409)—W. Matthews and E. Spencer.
Compressed air brake for trains composed of motor vehicles (17,470)—P. C. Rushen (*Knorr Bremse Akt.-Ges.*).
Brake accelerator for compressed air brakes (17,474)—P. C. Rushen (*Knorr Bremse Akt.-Ges.*).
Motor vehicles (16,966)—J. B. Skeoch.
Chassis for heavy automobiles (17,307)—Soc. Anon le Zebre.
Means for keying rails to chairs (17,387)—H. Swann.
Direction indicators for motor cars (17,448)—G. Wallace.
Vehicle direction indicator (16,875)—F. D. Walton.
Direction signal for motor vehicles (16,716)—V. R. Will.

SPECIFICATIONS PUBLISHED.

1918.

Securing rails to sleepers (16,043—*142,881*)—A. G. Liebmann.

1919.

Apparatus for controlling and stopping vehicles (6,304—*142,601*)—British Thomson-Houston Company (*General Electric Company*).
Motor road vehicles (6,479—*142,604*)—J. A. J. Evans.
Motor inspection platforms (6,699—*142,606*)—W. H. Newton.
Unpuncturable tire (7,535—*142,617*)—S. Howell.
Permanent way (8,745—*142,628*)—E. A. W. Phillips.
Power transmission mechanism for automobiles (9,943—*142,644*)—H. C. Reading.
Temporary axles for motor road vehicles (11,400—*142,658*)—G. S. Owen.
Gear boxes for motor vehicles (14,802—*142,691*)—T. Broadbent.
Frames or chassis of motor vehicles (15,942—*142,700*)—Thompson Brothers, H. J. Thompson, and J. W. Meredith.
Signalling device for road vehicles (3,297—*142,915*)—A. Cox.
Machines for printing, issuing, and counting fare tickets (3,459—*142,925*)—G. A. Julius and F. A. Wilkinson.
Trailer wagons for motor road vehicles (5,120—*142,957*)—J. Dyson, J. Dyson and E. Spencer.
Tipping gear for motor vehicles (5,598—*142,962*)—C. B. Rush and J. J. Morgan.
Motor road vehicles (10,354—*143,006*)—L. E. De Mole.
Control levers for use on motor vehicles (13,851—*143,054*)—Humber, Limited, and L. J. Shorter.
Electrical engine starting devices (14,684—*143,063* and 15,140—*143,068*)—S. T. Henn and Rushmores, Limited.
Constructions of apparatus for signalling direction of travel and stopping on road vehicles (16,963—*143,089*)—H. L. Zeitun and M. R. Moore.
Mechanism for tipping the bodies of trailer vehicles (3,071—*143,287*)—L. M. Spencer.
Tramway and railway rail chairs (7,912—*143,349*)—T. H. J. Thomas and T. Abbott.
Motor car bodies (9,640—*143,364*)—J. H. Bean.
Power transmission for motor vehicles (14,088—*143,402*)—Caterpillar Tractors, Limited (*Holt Manufacturing Company*).
Motor vehicles (21,792—*143,452*)—E. S. Alexander.
Motor driven vehicles (7,327—*143,671*)—E. C. R. Marks (*Cowan Truck Company*).
Lifting jacks (28,981—*143,798*)—F. De Benedetti.

1920.

Driving mechanism of motor vehicles (1,890—*138,105*).—L. Court.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1919. WEEKS ENDED					1920. WEEKS ENDED.					AGGREGATE.		
	May 31	June 7	June 14	June 21	June 28	May 29	June 5	June 12	June 19	June 26	Wks.	1920.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare U.D. Council	...	581	741	638	522	...	676	623	602	615	12	7,713	- 1,206
Aberdeen Corporation	4,850	...	5,119	3,305	3,998	6,017	...	4,776	3,956	3,975	3½	12,908	- 1,286
Ayr Corporation	777	717	685	716	706	679	649	715	748	746	6	4,129	- 418
Barrow Corporation	897	829	1,045	795	716	1,163	826	859	879	889	12	10,095	- 351
Belfast City Tramways	11,350	11,013	10,248	10,395	10,285	12,584	12,039	12,300	12,124	11,902	13	151,994	+ 18,949
Birkenhead Corporation	3,009	2,886	3,341	2,812	2,791	3,861	3,449	3,406	3,560	3,486	12½	42,345	+ 8,009
Birmingham Corporation	26,034	25,969	28,633	25,543	25,496	30,648	27,475	27,854	28,130	27,661	13	348,513	- 12,786
Birmingham Motor 'Buses	1,831	1,748	2,476	1,777	1,677	2,808	2,038	2,022	2,107	2,103	13	25,572	- 2,823
Blackburn Corporation	2,414	2,482	3,317	2,421	2,241	3,669	2,300	2,631	2,484	2,654	12½	32,550	+ 1,313
Bradford Corporation	11,365	11,731	14,006	11,161	10,977	15,234	12,031	12,315	12,633	12,314	13	156,977	+ 9,986
Burnley Corporation	2,979	3,069	3,650	2,920	3,149	4,178	3,548	3,488	3,458	3,451	—	—	—
Burton-on-Trent Corporation	483	502	563	485	472	643	514	520	565	575	13	7,078	+ 932
Bury Corporation	2,499	2,392	2,960	2,529	2,310	3,001	2,835	2,560	2,712	2,750	12½	33,235	- 1,365
Chatham and District	1,631	1,730	2,057	1,791	1,549	2,264	1,864	1,749	1,821	1,864	25	40,159	+ 4,407
Cork Electric	782	848	758	771	732	1,020	1,015	989	967	937	25	20,828	+ 5,373
Derby Corporation	2,089	2,159	2,514	2,062	1,952	2,640	2,078	2,080	2,286	2,198	13	27,530	+ 3,031
Dundee City	2,389	2,458	2,668	2,650	2,524	2,827	2,812	2,815	2,758	2,882	5½	15,503	+ 1,707
East Ham Corporation	2,016	2,029	2,261	1,963	1,768	2,050	1,878	1,846	2,036	1,957	12½	22,923	- 1,173
Edinburgh Corporation	12,793	12,317	12,337	12,033	12,253	13,577	12,882	12,310	12,818	12,705	6	75,473	+ 315
Edinburgh Motor 'Buses	...	...	...	...	...	...	...	...	...	841	6	4,294	—
Glasgow Corporation	35,176	33,912	33,345	32,918	32,880	35,746	42,290	45,108	45,396	44,957	3½	169,165	+ 47,307
Glossop (Urban Elec. Supply Co.)	226	231	274	256	222	277	234	231	244	230	26	6,071	- 239
Huddersfield Corporation	4,813	4,898	4,976	4,768	4,684	6,570	4,976	5,084	5,190	5,322	13	58,298	- 5,522
Ilford U.D. Council	1,275	1,320	1,547	1,296	1,267	1,513	1,238	1,202	1,303	1,261	12½	15,736	- 42
Ipswich Corporation	855	1,073	1,261	965	923	1,289	890	893	982	944	12	11,959	- 763
Isle of Thanet	978	1,016	1,729	1,474	1,389	1,688	1,237	1,251	1,470	1,664	38½	28,340	- 7,837
Kilmarnock Corporation	275	271	275	284	298	332	338	338	359	373	6	2,085	+ 223
Lanarkshire	4,204	4,169	4,081	4,069	4,110	4,462	4,323	4,627	4,494	4,543	25	103,711	+ 19,361
Leeds City	...	...	...	...	...	...	...	...	...	...	—	—	—
Leicester Corporation	5,984	6,210	7,353	5,988	5,792	8,112	6,763	6,792	7,182	6,831	—	—	—
Leyton U.D. Council	3,233	3,342	4,097	3,259	3,100	3,934	3,093	3,081	3,055	2,959	13	39,684	- 1,490
Liverpool Corporation	23,360	23,737	25,608	23,474	22,785	31,054	28,261	28,115	28,602	28,509	25¾	680,707	+ 130,698
London County Council	82,900	84,458	92,633	83,001	80,718	94,311	84,736	84,742	83,764	83,169	12	1,010,768	+ 34,157
Maidstone Corporation	355	375	463	375	352	592	480	464	483	467	12½	5,817	- 1,024
Manchester Corporation	30,947	31,099	33,793	31,792	30,304	34,411	32,093	32,306	32,613	33,501	13	351,678	— 34,242
Newcastle-on-Tyne Corporation	9,567	9,595	10,294	...	15,919	11,555	10,496	10,625	11,070	18,679	12	138,382	+ 17,555
Nottingham Corporation	7,096	7,230	8,667	7,039	6,844	9,317	7,537	7,685	7,993	7,721	12	94,515	+ 4,393
Oldham Corporation	4,931	4,755	5,186	4,769	4,373	5,078	5,050	4,668	4,763	5,155	14	60,609	866
Reading Corporation	1,634	1,602	1,936	1,688	1,569	2,307	2,268	1,824	1,656	1,633	12	20,654	+ 1,206
Reading Motor 'Buses	...	...	...	...	...	...	...	393	197	206	12	2,876	—
Rotherham Corporation	2,247	2,261	2,668	2,351	2,033	2,999	2,156	1,927	2,603	2,637	12	31,003	+ 3,072
St. Helens Corporation	...	...	...	...	...	2,565	1,887	1,971	2,057	2,118	12	23,641	—
Sheffield Corporation	17,213	17,041	19,224	16,524	16,399	23,118	20,228	20,220	20,550	21,528	13½	277,906	+ 48,655
Southampton Corporation	2,773	2,821	3,292	2,807	2,677	3,876	3,337	3,448	3,368	3,346	12	37,300	+ 3,279
Southampton Motor 'Buses	...	...	...	...	...	280	219	229	219	227	—	—	—
Southend Corporation	1,956	2,343	2,266	2,488	2,615	3,170	2,114	3,388	2,640	2,405	12	26,243	+ 1,285
South Shields Corporation	1,413	1,422	1,467	...	...	2,241	1,853	1,877	...	...	11	19,374	+ 4,786
Sunderland Corporation	2,948	3,047	3,722	2,845	2,895	3,577	3,002	3,040	3,232	3,374	13	38,575	+ 702
Swindon Corporation	343	331	490	408	387	474	387	387	375	380	12	4,597	+ 355
Tyneside Tramways and Tramroads	1,220	1,131	1,522	1,132	1,712	1,632	1,061	1,114	1,219	4,078	25	30,647	+ 5,395
Wallasey Corporation	2,644	2,582	3,306	2,659	2,485	3,397	2,563	2,577	2,689	2,649	12¾	32,237	- 527
Walsall Corporation	1,369	...	...	1,288	1,298	2,246	...	...	1,704	1,706	13	21,923	+ 3,667
Walthamstow U.D. Council	1,862	1,897	2,350	1,818	1,677	2,862	2,065	2,020	2,394	1,980	12¾	26,508	+ 3,523
Warrington Corporation	862	904	961	877	851	1,065	991	957	977	958	12	11,977	+ 1,114
West Ham Corporation	5,744	5,895	6,696	5,751	5,445	6,450	5,295	5,265	5,259	5,251	12½	66,360	- 3,862
Wolverhampton Corporation	2,028	2,019	2,981	1,999	1,875	3,345	2,339	2,331	2,318	2,378	12	29,281	+ 4,637

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1919. WEEKS ENDED.					1920. WEEKS ENDED					AGGREGATE.		
	May 31	June 7	June 14	June 21	June 28	May 29	June 5	June 12	June 19	June 26	Wks.	1920.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	65,786	21,250	22,535	38,580	56,145	78,054	74,755	78,960	76,217	78,361	25	1,880,675	+ 511,124
Calcutta Rs.	83,217	83,012	78,756	85,296	87,275	89,181	93,927	94,411	95,005	94,652	25½	2,327,449	+ 188,455
Madras Rs.	45,875	(2 weeks)	44,626	(2 weeks)	...	49,601	(2 weeks)	42,236	(2 weeks)	...	24	527,863	+ 119,169
Pernambuco	5,605	5,391	5,763	5,642	5,351	6,661	6,549	6,548	5,870	6,080	25½	188,792	+ 48,452

Companies issuing Monthly Statements only.

	1919.						1920.						Wks.	AGGREGATE.	
	Jan.	Feb.	Mar.	April	May	June	Jan	Feb.	Mar.	April	May	June		1919-20.	+ or -.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	3,603	3,052	3,623	4,291	3,266	...	4,250	4,279	4,182	4,933	3,672	...	8	8,605	+ 1,046
Brazilian Trac. Mlrs	8522000	7972000	9330000	9208000	9562000	...	9655000	9381000	9900000	10245000	10985000	...	22	50166000	+5,572,000
Brisbane	38,575	34,380	39,380	38,775	...	...	44,800	41,600	45,460	44,890	...	...	17	176,750	+ 25,640
British Columbia $	677,489	645,415	649,120	631,988	...	...	828,709	746,030	761,182	749,081	...	...	43	7,306,918	+1,284,811
Buenos Ayres L'c'z.	41,556	42,429	47,370	43,605	47,319	61,356	52,642	52,468	55,000	53,429	54,563	50,635	52	612,315	+ 69,455
Burma	38,265	35,926	38,440	36,814	38,900	...	41,749	41,814	45,117	44,673	46,785	...	43	449,197	+ 84,312
Cape Town	...	...	...	22,564	23,405	...	26,009	20,623	25,089	25,010	24,395	...	—	—	—
Carthagena & H.	3,655	2,351	2,400	1,786	3,226	3,373	4,748	4,008	3,493	5,482	5,313	5,562	26	623,511	+ 233,460
East India	1,970	1,689	2,016	1,920	2,131	2,323	2,988	3,001	3,592	3,916	3,980	3,862	47	35,411	+ 13,409
Kalgoorlie	2,562	2,278	2,653	...	...	...	2,573	2,677	3,142	...	...	...	13	8,392	+ 899
La Plata	5,730	6,698	6,592	5,631	...	...	3,155	6,894	6,392	6,142	...	...	17	22,583	- 2,066
Lima	45,362	46,110	50,716	49,980	...	...	58,585	56,050	60,325	57,415	...	...	17	232,375	- 40,168
Manila $	231,586	211,676	207,876	212,205	202,449	...	278,338	278,243	263,690	254,102	280,145	...	22	1,354,825	+ 289,033
Monte Video	40,910	...	...	...	37,382	...	47,767	...	...	...	42,401	...	30	307,299	+ 42,012
Para	24,515	23,248	26,022	25,342	24,503	...	24,306	24,303	24,883	24,771	25,842	...	26	148,517	+ 1,087
Peruvian $	...	...	1199420	...	1059150	...	...	...	1302820	..	1287070	...	—	13274884	+1,966,779
Port Elizabeth	...	...	...	5,576	5,145	...	7,827	6,166	7,214	6,381	6,165	...	—	—	—
Rangoon	6,373	5,694	7,533	6,217	6,533	...	7,467	7,667	8,698	7,857	7,933	...	22	39,622	+ 7,272
Toronto $	1106840	1015797	1083285	1051960	...	...	1130486	1113717	1255668	1211708	...	...	17	4,711,579	+ 453,697
Winnipeg $	390,539	371,162	384,937	367,196	...	...	498,837	444,873	456,915	431,685	...	...	17	1,832,310	+ 318,476

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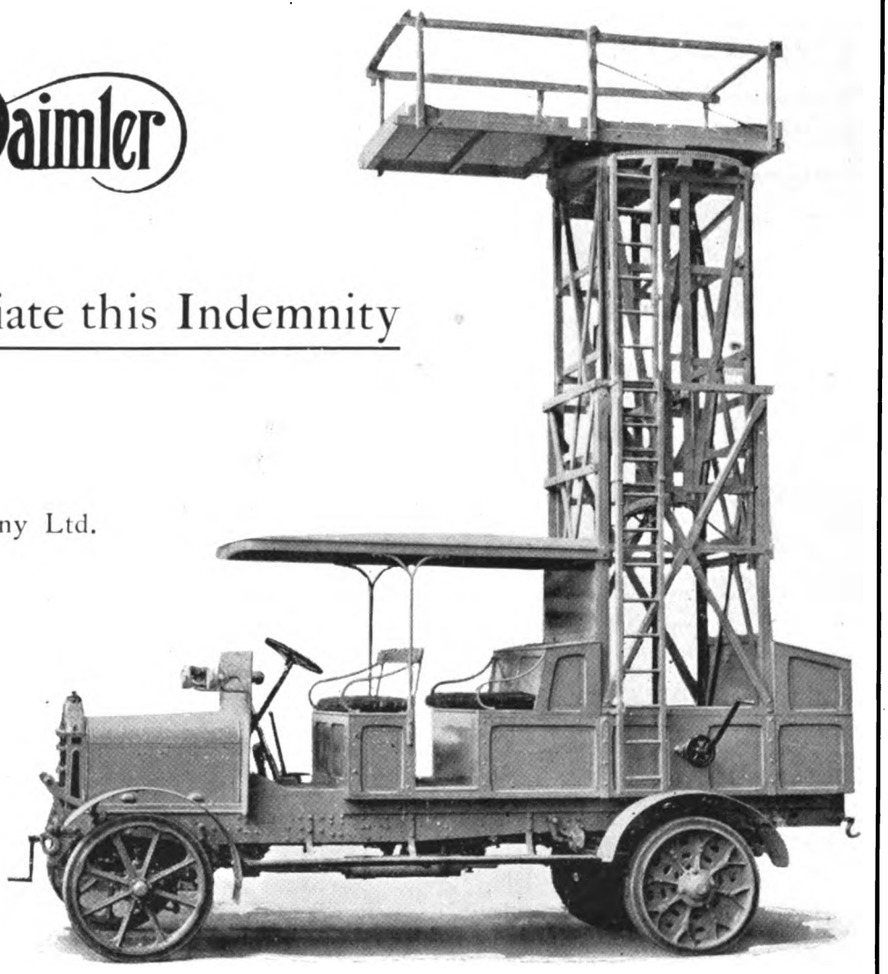

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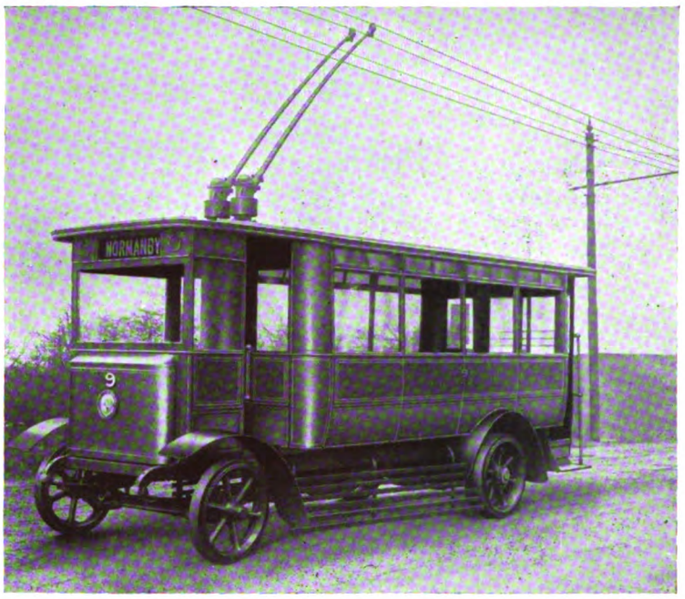

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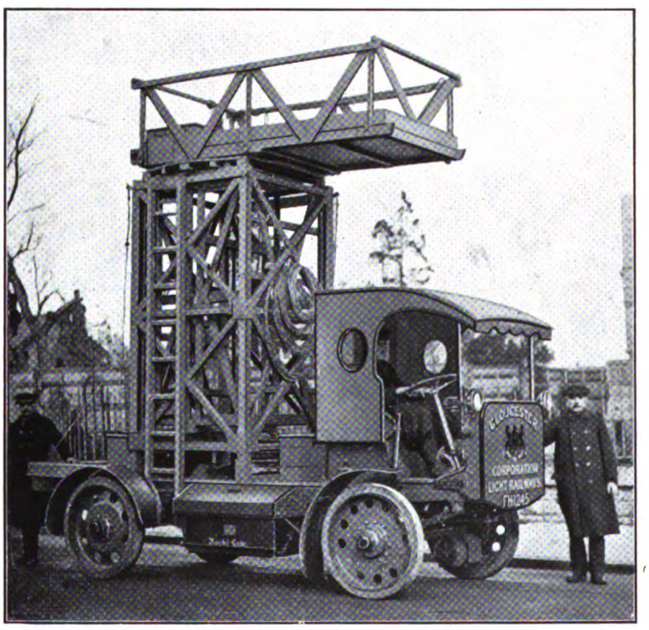

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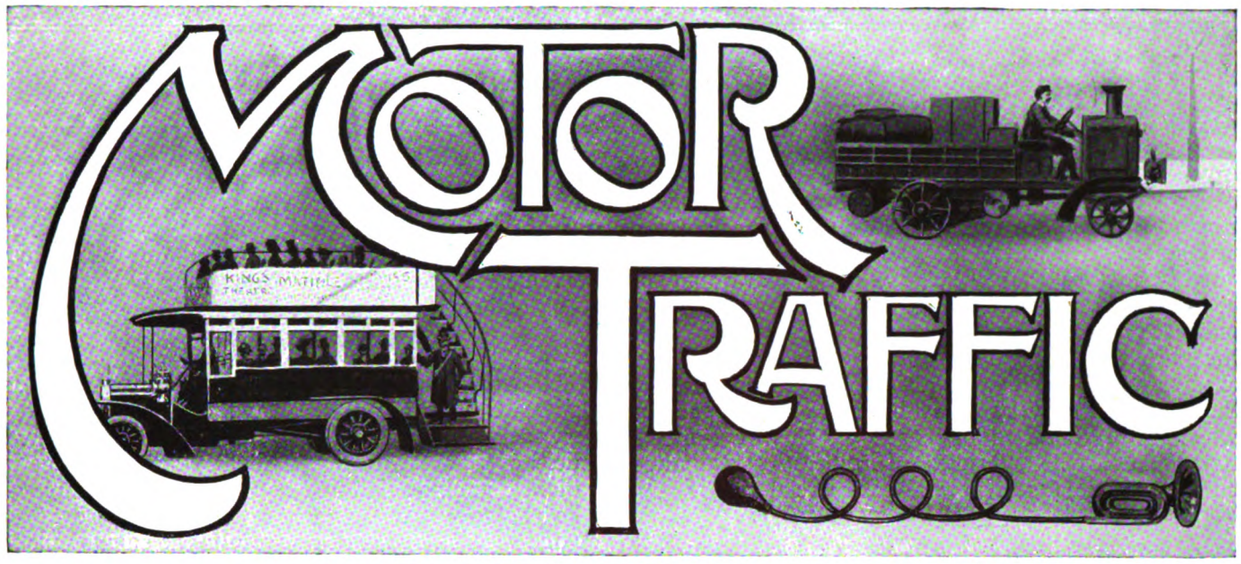

GIANT PNEUMATICS.

Extremists are declaring that the era of the solid rubber tire is almost over and that a revolution in road traffic will presently be brought about by the use of giant pneumatics even on the heaviest types of goods vehicles. Undoubtedly the giant pneumatic tire is rapidly becoming a practical proposition, but it is not safe to leap to the conclusion that the use of solids will presently cease on that account. So far as the goods vehicle is concerned, the choice must ultimately depend on financial considerations in nine cases out of ten. In the tenth case it will be influenced by the special importance in some instances of securing high speeds without vibration, of increasing the area of delivery, or of securing exceptional silence in running. These cases in which such considerations are of peculiar importance will enable operators to collect the necessary data upon which to determine the financial question, which must be answered before a general change can be contemplated. It is questionable whether it would be financially sound to put pneumatic wheels on to heavy vans and lorries now in service on solid tires. The first cost would be considerable, and the cost of tire maintenance would inevitably be increased. There might also be a certain risk of accident and irregularity of service due to the bursting and puncturing of tires. On the other hand, assuming equal speeds, there would be better protection from vibration, which should make for a lower repair bill. There would also be a somewhat lower fuel bill. Alternatively there might be an increased speed, thus gaining a greater radius of action and a larger daily mileage, which should, other things being equal, decrease the cost per mile run. It is difficult to say whether the advantages will outweigh the disadvantages; whether the savings will be more than enough to cover the extra costs.

* * *

As to public service vehicles, particularly those of the coach order, it is safe to forecast that the use of pneumatics will extend, higher fares being, if necessary, charged and obtained in return for higher speeds and a higher degree of comfort. The only point in this connection is the possibility of serious accident due to the bursting of a big tire on a heavy vehicle travelling fast. If this risk can be eliminated, development must assuredly be rapid, and the passenger-carrying vehicle will provide the statistics upon which decisions in respect of the goods carrying vehicle can later on be based. One thing is certain, namely, that if the pneumatic tire comes into such general use as is anticipated, new types of chassis will be designed in connection with it. It will not be merely a question of the adaptation of existing chassis.

THE COMMERCIAL VEHICLE SHOW.

The first really representative post-war exhibition of commercial motor vehicles will be held at Olympia next October. On the whole one does not anticipate that exhibits will be of a sensational character. Most manufacturers have been kept busy enough in reorganising, with a view to commercial output of types only differing from their predecessors in details suggested by war time experience. No doubt there will be improved devices for facilitating the use of heavier and cheaper fuels, and possibly combinations, such as the semi-trailer and new forms of following vehicles, will be shown in the anticipation of reasonable changes in motor law at an early date. We understand that at the time of the exhibition a conference will be organised by the Imperial Motor Transport Council somewhat on the lines of that held in 1913. The object of such conferences is, of course, to popularise the use of motor transport, particularly in the Empire overseas. Evidently, the extended use of motor vehicles must depend primarily on the general improvement of the road system of the Empire as a whole. To a great extent it must depend also on the availability of cheap and adequate supplies of fuel. Thus the conference will deal specially with the question of fuel and with the question of road development in relation to the development of mechanical transport. We are informed that Mr. Walter Long, First Lord of the Admiralty, will act as chairman of the Fuel Section, and Sir Eric Geddes, Minister of Transport, will preside over the Section dealing with Transport and Roads.

THE NEW SUBSIDY SCHEME.

A post-war subsidy scheme for motor vehicles suitable for military use is in course of preparation, and a conference has been held at the War Office at which motor users and manufacturers were represented. It is understood that the scheme now under consideration is in the nature of a stop-gap. It is not felt that the time is appropriate for asking manufacturers to disturb their output by producing vehicles of special types to the requirements of the War Department.

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MOTOR TRAFFIC

Any such move at the present moment would defeat its own ends, since the division of output among an increased number of types would mean higher costs of production and therefore enhanced prices. Consequently, a very large subsidy payment would be necessary to persuade users to purchase the types indicated by the War Office, and it is not at all probable that, with the prevalent call for economy, the Exchequer will be willing to allocate sums adequate for the payment of very big subsidies. The temporary scheme will therefore be based on the payment of strictly moderate subsidies in respect of a limited number of vehicles of normal commercial types.

THE LEFT-HAND DRIVE.

Vehicles fitted with left-hand drive have lately been coming in for a large share of criticism. There seems to be rather too much tendency to argue from the particular to the general. The fact of one or two accidents having occurred in which vehicles with left-hand drive have participated does not in itself prove that they are inherently dangerous. At the same time, if one considers the case dispassionately, there is no doubt but that the right-hand drive is preferable on our roads and that the presence of a large number of vehicles with left-hand drive would probably constitute a positive danger, sufficiently serious to demand attention. The argument that if this is so, then the right-hand drive must be equally dangerous in countries where the opposite rule of the road is in force does not necessarily hold good. For one thing, even the main roads in our towns are generally somewhat narrow and traffic is congested to a point unknown in many countries. For another, our country roads and lanes are generally bounded by high hedges, obscuring the view round corners, and are very narrow and winding. The main objections to the left-hand drive are—

(1) When turning a corner to the left on a country road the driver is in the worst possible position to see ahead unless he drives on the wrong side of the road. With the right-hand drive his position is moderately good, whether the bend is to the left or to the right.

(2) When overtaking slow-moving vehicles of a bulky character, it is necessary to see more or less round them before it is safe to pass them. With the left-hand drive one must swing out of the ordinary traffic line a considerable distance before getting a clear view ahead. If traffic is congested this may well be dangerous, and it may even be impossible for long periods owing to the proximity of the line of traffic proceeding in the opposite direction.

(3) When turning in the road or turning out of the road towards the right, the driver who has a left-hand drive cannot signal his intentions to following traffic. The same argument does not apply in the reverse sense because there is no question of following traffic attempting to pass on the left.

Altogether there appears to be no particular reason why, with all the difficulties of traffic congestion with which we suffer, we should allow those difficulties to be increased by permitting foreign manufacturers to send to this country cars which could be rendered far more suitable by a change of design that could be readily effected at small cost in the first instance. Consequently, there is a good deal to be said for the argument that it would be good policy to prohibit the import of vehicles with left-hand drive after a certain date to be agreed.

ALCOHOL BENZOL MIXTURES.

The tests of alcohol benzol mixtures by the London General Omnibus Company have, on the whole, led to very satisfactory results. The fuel gives better thermal efficiency than petrol, but a slightly lower mileage per gallon, assuming a half-and-half mixture to be employed. The engine power is much better maintained at low engine speeds. To get these results the engine must be slightly modified, the compression being increased by fitting special pistons. Also the carburetter adjustments must be altered and the inlet should be hot-water jacketed. The mixture seems to tend to cause deposits round the inlet valves, which means a certain amount of extra cleaning, say about once a month, if the machine is regularly used. Another difficulty is that the fuel acts upon iron or copper. Fortunately it has no effect upon lead, so that this possible trouble is eliminated if fuel tanks and pipes are lead lined. The London General Omnibus Company are proceeding with further experiments on other alcohol mixtures, and supplies of power alcohol are being delivered to a limited number of other users for tests on the road and to manufacturers for experiments with engines and carburetters. The industry has, in fact, made the first practical move towards the time when power alcohol will become the standard motor fuel.

WALTHAMSTOW TRAMWAY MANAGER ASKS FOR OMNIBUSES.

In his annual report Mr. William Murray, the Walthamstow Council tramways manager, recalls that in March, 1919, he made a report on tramway extensions, and, *inter alia*, urged the advisability of securing powers to run motor omnibuses within the district. The tramways committee recommended that steps to this end should be taken and in his monthly report of February last he urged the need for the recommendation being put into effect at once.

Various causes have so far combined to delay action in this matter, but he hopes that a definite move will be made during the current year. As he has frequently urged, an omnibus service would be invaluable as an auxiliary during rush times to the present tramway service; it would be most useful and a great public convenience, should they require to close any of the routes during the reconstruction of the track, and it would be of service in meeting the needs of outlying districts such as Highams Park. The growth of the town will make the provision of further travelling facilities imperatively necessary, and the Council would be amply justified in pressing on with this matter.

MOTOR VEHICLE TAXATION.

THE NEW SCHEME PASSED BY THE COMMONS.

In the House of Commons on July 6, on the consideration of Clause 11 of the Finance Bill, which abolishes the duty on motor spirits, Sir W. Joynson Hicks moved the rejection of the provision for taxing vehicles on the basis of horse-power. The fairest method would be to continue the duty on petrol. After discussion, the amendment was negatived by 228 votes to 43, and the clause agreed to.

Clause 12, which imposes additional duties on licences for mechanically propelled vehicles, was also adopted.

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MOTOR TRAFFIC

A SECTIONAL HOOD FOR MOTOR COACHES.

EASY TO MANIPULATE AND COMFORTABLE FOR PASSENGERS.

A sectional hood for motor-coaches has been placed upon the market by Messrs. James Bartle and Company, Limited, of Lancaster Road, Notting Hill, London, W. It is so constructed that its advantages will be much appreciated by the ever increasingly large number

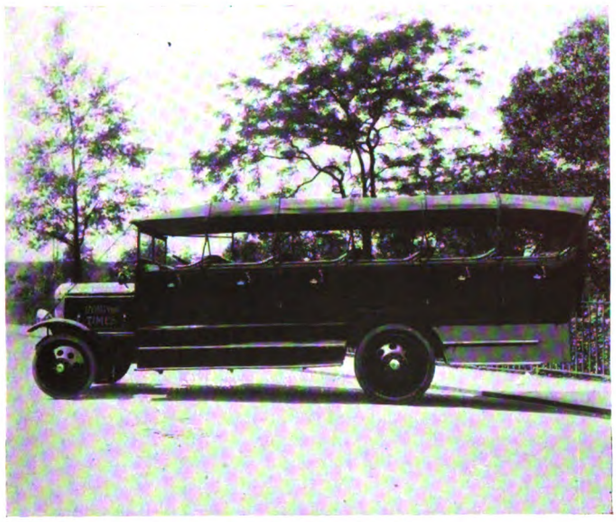

Fig. 1.—Bartle's Sectional Hood when Extended.

of people interested in this popular type of vehicle. For some time past Messrs. Bartle have mainly devoted their extensive works to the design and construction of improved types of motor-coaches, and as an outcome of the experience so obtained they have designed a new type of hood to take the place of the heavy Cape cart hood usually fitted to this class of vehicle, which in practice is frequently found to be a source of irritation and annoyance whenever required for use. The manipulation of the large hood of a 30-seat vehicle requires the united efforts of at least four men, and when finally folded down behind the rear seats, its great weight puts a

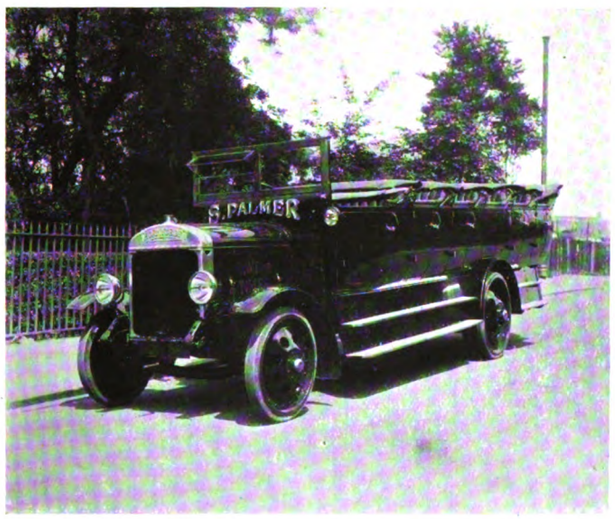

Fig. 2.—Sectional Hood when Out of Use.

considerable strain upon that part of the body where it is least desirable. Sooner or later the encumbrance leads to serious damage to the rear construction of the vehicle.

The hood which Messrs. Bartle are now able to offer to all motor-coach proprietors, is an entirely new type. Its introduction at once removed the main objections to many of the existing types, and at the same time the new design incorporates a number of improvements which add considerably to the comfort of the passengers. The main feature of this new hood is that it is made in as many sections as there are rows of seats, each section folding compactly at the back of the seat without interfering with the comfort of the occupants or detracting from the width of any of the gangways. Each section consists of two bent hoops of steel, the longer one being mounted upon the steel links of an ingenious design, which not only shorten the hood in order to ensure the necessary compactness when down, but also hold it in an upright position when raised. To each of the long hoops a shorter one is attached, and when the hood is raised this is carried forward to the next hoop in front and locked in position by an eccentric lock designed for the purpose. The waterproof twill is fastened to both hoops, thus forming a complete section of the hood. Each joint of the hood is provided with brass waterplates so that the complete hood is perfectly waterproof. As each seat has a separate hood, it will be seen that the section can be quickly and easily manipulated by one man, while this arrangement equally distributes the weight over the length of the body.

The accompanying illustrations show the hood completely up (Fig. 1) and down (Fig. 2), and also a view (Fig. 3) with only the forward sections in the raised position. From these photographs a good idea of the form of construction will be gathered together

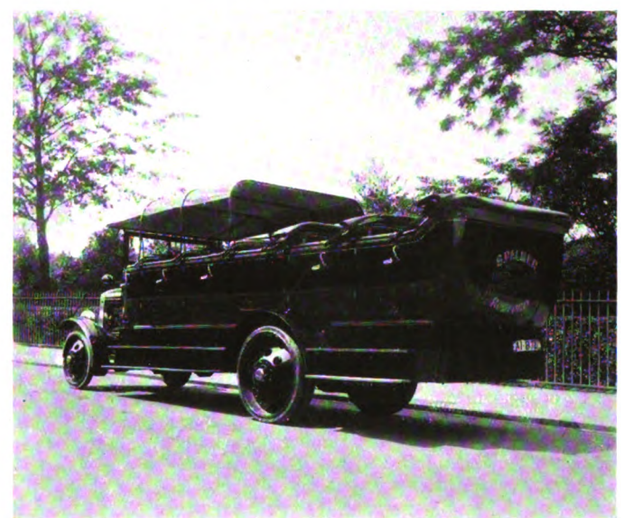

Fig. 3.—Showing Forward Sections of Hood in Use.

with the ease of manipulation. It is claimed that each section of the hood will give a practically unlimited length of service, as the usual conditions under which the twill is torn and chafed are entirely eliminated. Moreover, the fittings which are directly attached to the body are so arranged that they can be adapted to practically any type of motor coach with any number of rows of seats. The fittings have been designed and manufactured in Messrs. Bartle's factory, and owing to the scientific distribution of the parts the weight of these has been reduced to the minimum consistent with the service required.

A motor coach which in itself is an excellent example of Messrs. Bartle's coach work was shown on their stand at the R.A.S.E. at Darlington. It is mounted on a "J" type Thornycroft chassis and is fitted with this new type of hood.

NEW CHASSIS FOR GRIMSBY TRAMWAYS COMPANY.

The Palladium Autocars, Limited, commercial vehicle manufacturers, of Felsham Road, Putney, S.W., have received a further order from the Great Grimsby Street Tramways Company for a fleet of eight of their 4-ton chassis for omnibus and chars-a-bancs passenger service in and about Grimsby.

The Palladium Autocars, Limited have also received a repeat order from Messrs. Trollope and Colls, Limited, for an addition of four of their 4-ton vehicles. When these have been delivered the firm will have a fleet of eight Palladium 4-ton vehicles.

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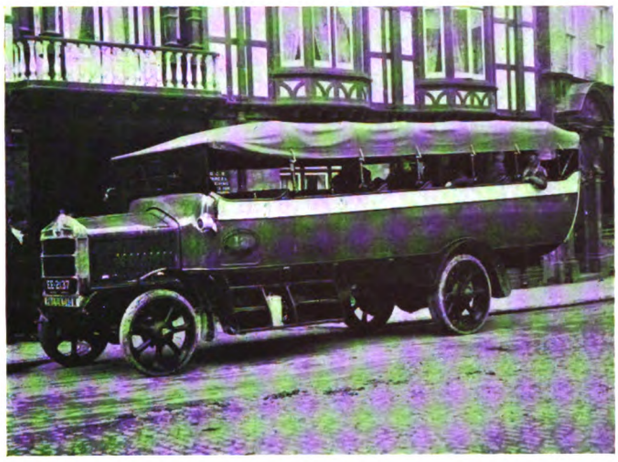
COACH TRAFFIC AT GRIMSBY.

THE TRAMWAY COMPANY'S ENTERPRISE.

The Provincial Tramways Company, Limited (Grimsby), was amongst the first to develop road motor traffic, and on the conclusion of the war Mr. H. L. White and his staff set to work to further meet public requirements in the way of pleasure traffic. The result is the provision of several new 45 H.P. "Palladium" 31-36 seat



"Palladium" Coach—Grimsby Tramways.

chars-a-bancs, which embrace several new and improved features in design and construction. On this page will be seen an illustration of the vehicle.

The entrance is at the front, two doors being provided, one for the driver and the other in the main body of the car, the latter door being particularly wide. The central gangway provides access to the seats, which seat two passengers each, excepting directly behind the driver (three passengers) and the rear seat (five passengers). Gangway seats which accommodate five additional passengers can be brought into use, these forming part of the sides of the main seats, to be let down as required to form the extra seat. The seats, moreover, are arranged on a sloping floor enabling all passengers to have a clear view ahead.

Contrary to the usual practice, the sides and the back of the body are panelled in mahogany, while the rear corner pieces are also of wood. This form of construction results in quieter running when the car is in motion over uneven ground, as no drumming effects are produced as when sheet metal is employed. As will be seen from the view of the car, three steps are provided in the place of the usual two. The top step is inside the body. This space is covered when the car is travelling by a hinged flap fitted to the door, and the flap when down, prevents the door opening in the event of any passengers leaning against it. The rear of the body is protected by a covered steel buffer, effectively protecting the rear of the body from being damaged.

The Provincial Tramways Company have found that the "Palladium" chassis is particularly adaptable for large chars-a-bancs bodies, due to the whole of the chassis frame being utilised, as the radiator is mounted nearly at the end of the dumb irons, about two feet being thus gained for body space as compared to other chassis. The fact that the 45 H.P. engine is quiet running, and is capable of climbing severe gradients with ease, combines to make it an ideal machine for long or short touring. The easy gliding effect when starting, for which the multiple plate clutch is responsible, also contributes to making this vehicle a favourite with the public. The Provincial Tramways Company, Limited, have in service eight "Palladium" chassis, which are proving highly satisfactory under the severest working conditions. The body has been designed and built to the specification of the company's engineer, Mr. H. Orme White.

MANCHESTER CORPORATION PAVING COMMITTEE has decided on the purchase of three petrol motor lorries at a total of £3,500, and two motor cars at a total of £1,050.

INSTITUTION OF AUTOMOBILE ENGINEERS.

What is undoubtedly the most successful visit ever arranged by the Institution of Automobile Engineers took place at the end of June. Well over 100 members met at Derby on June 22, and were shown over the Rolls Royce Works in the morning, where the members were impressed by the extraordinary care taken in the fitting of every item and the amount of human skill which is relied upon in the production of this car. After being entertained to lunch by the directors of the Rolls Royce Company they visited many departments of the Midland Railway Company's locomotive works, and were entertained to tea by the president-elect, Sir Henry Fowler, K.B.E.

June 23 and 24 were spent in Sheffield, where the following steel-makers kindly threw open their works for inspection:—

J. H. Andrew and Company, J. Brown and Company, Cammell, Laird and Company, Firth Derihon Stampings, Jonas and Colver, A. Lee and Sons, Sanderson Brothers and Newbould, Steel, Peech and Tozer, Edgar Allen and Company, Brown Bayley's Steel Works, Thos. Forth and Sons, Hadfields, Limited, Kayser Ellison and Company, G. Turton, Platts and Company, Ambrose Shardlow and Company, Vickers Limited.

It is impossible to detail all the processes which were inspected, but there is no doubt that the visit to Sheffield has had valuable results in bringing the automobile engineer and the steel-maker into closer personal touch, so that the solution of difficulties with which each may be confronted will be much more easily arrived at in future than has been the case in the past.

The first meeting of the Institution of Automobile Engineers for session 1920-1921 will be held on October 13, when Sir Hy. Fowler, K.B.E., will give his presidential address. Subsequent meetings will be held on the second Wednesday in each month up to May 11. The Birmingham meetings will be held on October 28, December 30, February 24, and April 28. The London graduates' meetings will be held on the second Thursday in each month, and the Birmingham graduates on the third Wednesday in each month.

The first annual dinner of the Institution will be held at the Royal Automobile Club on October 27.

A NAPIER RECORD IN THE FAR EAST.

At first glance the photograph reproduced below might be taken for a picture of a Government store for motor vehicles, but in reality it depicts a Napier business vehicle on a "road" in Persia.

A convoy of Napier business vehicles were employed in this area

A Napier Taking Everything in the Day's Work.

for two years, making runs over a distance of 90 miles or more, and the illustration gives some idea of the strenuous work these vehicles were called upon to do. That they carried on for so long without giving any trouble in an area which had never before been traversed by mechanically-propelled vehicles says much for the workmanship and material used in the construction of the Napier.

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MOTOR TRAFFIC

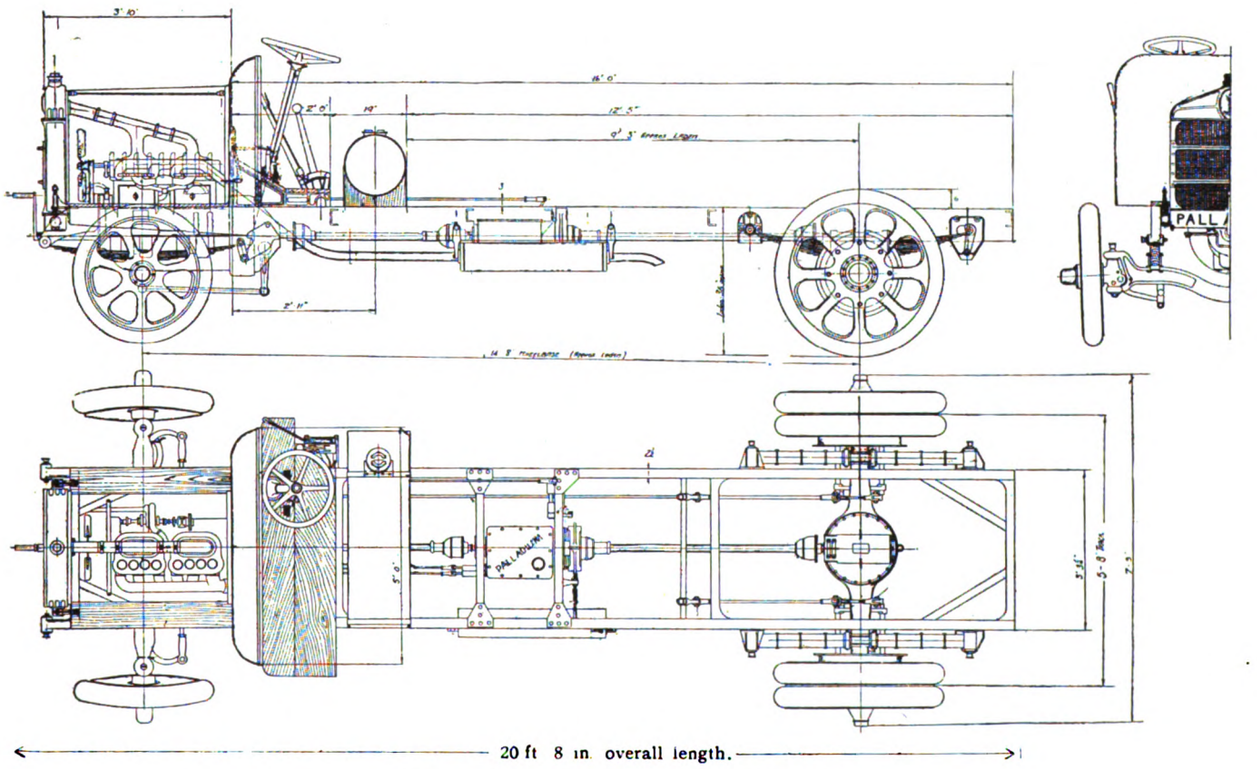
THE WALLACE 30-CWT. LORRY.

SPECIFICATION OF A NOTABLE CHASSIS.

Considerable interest has been evoked by the latest departure by Mr. S. A. Wallace, one of the most notable personalities in the motor industry during the past few years. Coming from the United States after an intimate association with the best practice in motor engineering and commerce, Mr. Wallace did great work for the Associated Equipment Company, which builds the London omnibuses. Next he started the wheels of industry at the Government motor depot at Slough, and when the works had been well established he took a hand in introducing offers for purchase. His latest enterprise—placing on the market a 30-cwt. lorry—constitutes the fulfilment of a plan which he has long had in mind, namely, to offer to the business community a light vehicle of conspicuous merit. Mr. Wallace is of opinion that there is scope in this country for supplying forty thousand chassis of 30 cwt. The Wallace chassis is being marketed by the Richmond Motor Lorries, Limited, of 222, Great Portland Street, W.1 (with Major E. H. Allday as managing director) and works just completed at 1, Bloemfontein Avenue, Shepherds Bush, W. 12. The machine has lately proved its capabilities by carrying full loads up Pebblecombe Hill, one of the steepest inclines in Surrey, with gradients as steep as 1 in 5½. The road up the hill is not only on a curve, but it is in wretched condition, and its ascent by a fully loaded 30-cwt. lorry is convincing as to the capacity of the machine. A local coal dealer meeting a machine at the top of the hill on its first test, asked in surprise if that lorry had come up that hill. On seeing the vehicle again make the ascent, he observed, "That's good enough for me. I'll take two," and he did.

Unique conditions accompanying the sale of this chassis is that it is guaranteed for twelve months, while free advice and inspection are given for two years.

A Wallace Lorry Climbing Pebblecombe Hill, Surrey.



Plan and Elevation of the Wallace Chassis.

The chassis has a Continental Red Seal engine, with four cylinders cast *en bloc*; "L" head with enclosed valves; bore 3¾ in. by 5 in. stroke. It is of 25 H.P. at 1,400 revolutions per minute, the R.A.C. rating being 22·5. The weight is 410 lb. It has three-point suspension, with the third point around the starting crank housing with recoil springs under rear support arms. The flywheel is fitted with ring gear to take a self-starter, which can be supplied as an extra.

The oiling system comprises combination force feed and splash system. Provision is made for proper draining of the oil and removal of the strainer for cleaning. There are no grease cups; oil cups only are used for lubrication.

Cooling is effected by a centrifugal water pump and belt-driven fan having four blades. Simple adjustment for taking up belt slack is provided. The radiator is of the vertical tube type, with massive cast tanks and frame. The tank has a capacity of 5 gallons of water.

The carburetter is the Zenith, fitted with hand and foot operated controls, ensuring maximum economy and efficiency under all conditions.

Ignition is by the Eisemann high tension magneto controlled by ignition advance lever drawn through special flexible coupling on steering column, and provided with a special key-operated switch. The clutch has multiple disc dry plates faced with asbestos fabric. The action is positive, friction being set up through the operation

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of asbestos fabric against steel plates. There can be no slipping. Smoothness of engagement is another feature. The whole unit is entirely enclosed.

Transmission.—Selective sliding gear, three speeds forward and one reverse, bolted securely to the engine, and forming one unit. Nickel-steel gears and chrome nickel shafts of large diameter. The gear ratios comprise—First speed, 25·31 ; second speed, 12·77 ; third speed, 7·6 ; and reverse.

A silencer of special Wallace design is fitted. It is a new type, very small and simple, and is easily dismantled for cleaning.

The wheelbase is 144 in., the track 58 in., and the turning width without reversing 25 ft. The frame is of pressed steel with all spring hangers and cross members hot rivetted ; 5 in. section, with 2½ in. flange, ¼ in. stock. Four cross members are used. Rear end of frame is provided with diagonal braces, so providing additional strength for towing hooks when required.

Springs are of special silico-manganese heat-treated steel. All four springs are provided with double wrapped eyes, obtained by wrapping the top and second leaves of each spring round the spring eye, giving additional strength and making breakage almost impossible. A further feature is the Wallace design of fixing the spring bolts through the use of a special cup depression in each spring which nests in the spring leaf underneath it, so obviating the breakage of spring centre bolts.

The front axle is of dropped forge I beam of 2 in. by 2¾ in. section, of special heat-treated steel. The steering arms are pivoted in hardened and ground steel swivel pins and hardened bushes, and the thrust is taken by a ball thrust bearing. Wheels pivot on Timken taper roller bearings. The rear axle is of the famous "Clark" internal gear drive type, in which 1⅛ in. diameter driving shafts of heat-treated nickel are embodied. The load is entirely carried on a solid forged axle member having wheel spindle 1 31/32 in. diameter. Completely enclosed internal gears, eliminating dirt and grit. Road clearance, 14 in.

Two independent sets of brakes both act on rear wheels. Thermoid brake lining is used on both external bands and internal shoes. The action of both hand and foot brakes is compensated by a simple Wallace brake equaliser on the principle of the differential gear.

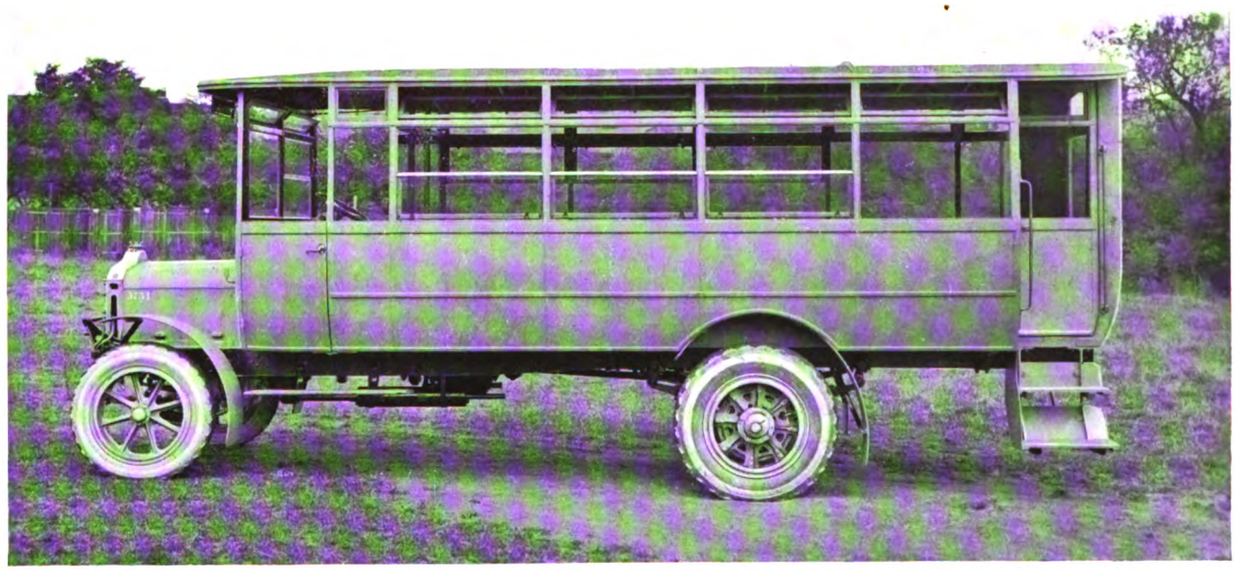
Control is by right-hand drive and centrally situated change-speed lever. Throttle and ignition advance levers mounted on right-hand side of steering column in convenient position. Foot accelerator pedal also provided. The wheels are of the artillery type. All wheels run on Timken taper roller bearings.

The petrol tank has a capacity of 20 gallons, with vacuum feed. It is mounted under the driver's seat, and provided with efficient petrol strainer. The dashboard is of heavy gauge steel, designed so as to be fireproof. The loading space from behind driver's seat to end of frame is 120 in. The equipment comprises a set of front wings of heavy gauge material ; two steps in hard wood carried on strongly made brackets ; Wallace collision bar of spring steel ; three oil lamps ; hand-operated Klaxon horn ; complete tool kit ; instruction hand book on the care and driving of Wallace lorries ; and an instruction book on the Eisemann magneto.

The weight of the chassis is 3,800 lb., and it is finished in lead colour. The price of the chassis is £675 net ex Works, London. Pneumatic tires and electric lighting set and self-starter are supplied as extras. Any type of body can be obtained.

OMNIBUS ON PNEUMATIC TIRES.

The omnibus illustrated below is of special interest, as it is one of the earliest single-deck omnibuses running on pneumatic tires. These tires are of the Goodyear cord type. Those on the front wheels are 36 in. by 6 in., and on the rear wheels 40 in. by 6 in. The chassis is of the Daimler 2-3 ton type (C.K. 22), and the body is of Dodson's standard C.D. 19 type, constructed to carry 36 passengers inside and three beside the driver. Ample ventilation is provided for the interior, as the upper half of three windows on each side fold down. The interior is upholstered in real leather, and the seats have Hall spring cushions.



Pneumatic Tires to a 36-Passenger Omnibus.

CENTRAL GARAGE PROPOSALS.

The Bradford Corporation sub-committee which were appointed to go into the question of a central garage, have arranged to inquire about suitable sites and with regard to management of large garages.

Rotherham Corporation have asked the borough engineer and tramways manager to prepare a scheme for a central garage for the motors belonging to the various departments of the Corporation.

Walthamstow Council propose a central garage for their motor vehicles, and suggest that a sub-committee should consider the advisability of setting up a repair department.

Glasgow's Proposed New Road.—Regarding the offer of the Ministry of Transport to contribute £40,000 towards the cost of the construction of a road from Glasgow to Renfrew, it is now intimated that the Ministry will consider a further contribution if and when further funds are available for highway improvements.

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LONDON COUNTY COUNCIL'S BILL FOR OMNIBUS POWERS.

A Select Committee of the House of Commons on June 15 began the hearing of the clauses of the London County Council's bill in which powers were sought to expend £400,000 to inaugurate omnibus services in connection with the Council's tramways. In opening the case for the London County Council, Mr. Vesey Knox, K.C., stated that the dropping of the tramway provisions of the bill made it the more urgent to run omnibuses. Another reason was that the Council might get the full value out of their tramways undertaking. At the new housing estates at Dagenham, Grove Park, Dover House, and Barnes, over 200,000 people would be housed.

Witnesses for the Council.

Mr. G. H. Hume, formerly chairman of the Highways committee of the County Council, gave evidence in support of the bill.

Replying to Mr. Freeman, K.C. (representing local authorities), Mr. Hume denied that the scheme was intended to ward off possible future attacks. The Council believed that competition between undertakings was wasteful and ought to be avoided.

By Mr. Lloyd, K.C. (for the London General Omnibus Company): He did not desire to run competitive services beyond those of the existing tramways. He agreed that if the bill was to give the Council only what they desired it must be curtailed.

Mr. A. L. C. Fell, general manager of the Council's tramways, giving evidence, stated that the average number of journeys by the population had increased in recent years, and the increase was continuing. Very large numbers of passengers were brought to tramway termini, from which there was a very inadequate omnibus service, notably at Blackfriars and Westminster Bridges. If each omnibus earned 23d. per mile there would be a small amount of profit. The omnibuses would also act as feeders of the tramways. Apart from the additional tramway passengers who would be secured, the omnibuses ought to be run without any loss.

On June 17, Mr. Fell, cross-examined by Mr. Lloyd, stated that out of 69 authorities which had been granted powers to operate omnibuses, 55 also had tramways. So far as he knew, there were no competing services in any of those places.

Mr. Lloyd remarked that Lowestoft Corporation applied for omnibus powers, to which a company objected, with the result that a clause was inserted to render the grant of powers inoperative so long as an efficient service was provided by private enterprise.

Mr. F. Hunt, valuer to the London County Council, stated that the London Omnibus service had serious defects, particularly in the handling of workmen's traffic. Of 95 services running into the centre of London 30 started before 7 a.m., 28 between 7 a.m. and 7.30 a.m., and 37 after 7.30 a.m. The Council's workmen's cars began at 4.30 a.m. One object in promoting the present bill was to assist in solving the housing problem.

The Opposition.

On June 22, Sir L. Macassey (Surrey County Council), contended that the power sought to run omnibuses in Surrey was not necessary to meet any existing need. No details of routes had been given, no case had been made out by the County Council.

Mr. C. B. Edgar, M.P., a member of Surrey County Council, and representatives of other local authorites stated their objections.

On June 24, Mr. Lloyd, K.C., introduced the opposition of the London Underground Railways and the London General Omnibus company. He remarked that those companies had recently been to the House of Commons to ask for an increase of fares, and owing to changes that had taken place the omnibuses were carrying on at a heavy loss. The County Council's tramways were no better off. Services which ought to be a gold mine for everybody, without disadvantage to the public, were struggling with financial difficulties. The Council proposed to add to the difficulties by running omnibuses. The Underground Railways and the Omnibus Company were the only people who had attempted to co-ordinate London traffic. At present every omnibus running in London was either under the control of the General Omnibus Company, or running in arrangement with it. To give the Council a free hand to embark on this new business would prevent private enterprise raising capital for extensions urgently needed.

Mr. Frank Pick, commercial manager of the Underground group gave evidence. As to the proposal of the Council to run omnibuses between Blackfriars and Farringdon Street tram terminus, Mr. Pick said that omnibuses already running over the route were not among the best patronised, and the scheme would add to the congestion. The remedy was through services such as the Company provided in order to carry the people right away. The route from Charing Cross, along Tottenham Court Road and Marylebone Road, on which the Council proposed to run, was well provided with omnibuses and railways. The requirements of the other suggested routes were well met.

Questioned in regard to the housing schemes planned for London and its environs, Mr. Pick asserted that ample provision existed to meet the traffic needs. He denied the assertion that the company did not provide early-morning services, and stated that omnibuses started from two depots before five o'clock; from four between 5.0 and 5.30; from nineteen between 5.30 and 6.0; from twenty-seven between 6.0 and 6.30, and from fifty-five between 6.30 and 7.0. They ran 112 trips at ordinary fares in the early morning to carry the traffic to industrial works. On the main routes there was need for both the tramways and omnibus services. They never deliberately set themselves to kill the tramway traffic. What they wanted was co-ordination.

Attitude of the Ministry of Transport.

Sir H. Maybury, director of the roads department of the Ministry of Transport, gave evidence, on June 29, that in the opinion of the Ministry the Council should define the routes on which they intended to run omnibuses. There was a great deal to be said for the Council linking-up housing sites with the tramways and railways. The reason why it was desirable the committee should fix the routes was that congestion of traffic might be increased by the new services. Probably there might be next year a London Traffic Authority. The Ministry was in sympathy with the linking up of the tramways so long as that did not increase congestion. Though the Ministry desired to leave the fixing of the routes to the committee, they would fix the routes if directed to.

Further L.G.O.C. Evidence: Railways Needed.

The cross-examination of Mr. Pick, commercial manager to the Underground group, now took place. He admitted that omnibus fares in the central area were higher than in the districts served by the tramways. The average fare in competition with the tramways was a penny a mile, but in the central area it was 1½d. per mile. It was the policy to have the higher fares in the central area, because there was congestion there, and the omnibuses had to stop oftener to pick up and let down passengers. The County Council had not consulted the company regarding the increase of fares. The Council's mid-day fare of 2d. all the way, was a deliberate attempt to take away the traffic of the omnibuses. On some of the proposed linking up services the omnibus service was already in excess of the passengers. The combine ran omnibuses alongside their own tramways, as omnibuses provided for traffic for which the tramways did not cater.

Lord Ashfield, chairman of the Underground group, referred to indications that London County had reached its highest development of population, and had begun to decline. Development was now chiefly outside the county. London must depend more and more upon railways. Long distance fast traffic could not be provided by tramways and omnibuses. A central traffic authority was necessary. The number of journeys per head of the population of greater London was more than in any other community in the world.

Continuing his evidence on June 30, Lord Ashfield referred to the Council's bill as an attempt to establish competition with the existing undertakings, whose financial outlook was already very serious. For many years co-ordination in regard to London traffic had been urged by various authorities but nothing had been done except by the combine. He hoped to see established a central authority which should have power to dictate routes. While the combine had been carrying out this policy of co-ordination they had not received much assistance from the County Council. The tramways served a useful purpose, and would continue to do so. With regard to fares, there appeared to be a suspicion on the part of the Council that the combine were not acting fairly, but if omnibus fares were raised without raising the Underground fares, traffic would be diverted from the omnibuses to the Underground, which was already overburdened. The companies preferred to wait until their bill dealing with fares had been dealt with. In 1910, before the combine's facilities were co-ordinated, the number of accidents per 100,000 miles run worked out at 67·31, against 15·79 in May last.

The Committee's Decision.

Re-assembling on July 1, Sir W. H. Davies said the committee had decided in favour of the opposition of the local authorities outside the county of London. So far as the linking up of the tramways north and south was concerned, they granted powers

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within a circumscribed area, bounded by London Bridge on the east, and Westminster Bridge on the west. A clause would have to be brought up defining the limited powers. The County Council as the tramway authority had discharged a great public work with considerable satisfaction to the public, and without any assistance from the State. Otherwise the committee would not have granted the limited powers. The powers would have to be exercised with the approval of the Ministry of Transport and the police. The services must be strictly linking-up services. The committee considered that a London traffic authority was necessary at the earliest possible moment. They believed that with such an authority it would be much easier for the County Council to negotiate than they were able to do now, seeing that they were a statutory body and the bodies with whom they were competing were not. The committee realised that within the next year or two the housing estates would have developed so much as to require a great deal of traffic accommodation. They hoped that by next year a traffic authority would be set up with power of appeal to that authority to settle who should have the right of going to those districts.

The committee on July 6 approved of a clause submitted by Mr. Knox, K.C. for the County Council, defining the area in which the council are to be permitted to operate omnibuses. The clause is as appended—

Notwithstanding anything contained in any other Act, the council may provide, equip, work, and run motor omnibuses for the purpose of linking up their tramways on any routes which may be approved by the Minister of Transport within the defined area (roughly from Harrow Road to Aldgate on the north, and from Victoria Station to Westminster Bridge, the Elephant and Castle, and Tower Bridge on the south) and to the nearest convenient turning point beyond the defined area on or near the tramways of the council. Notice of the intention of the council to apply to the Ministry of Transport for such approval shall be given to the highway authority of the district in or through which such service is proposed to be run, and that authority shall have the right to make such representations thereon as they may think fit to the Ministry of Transport.

Counsel stated that the area submitted was rather wider than that indicated in the decision of the committee, but it would be more convenient to work.

ELECTRIC VEHICLE ORDERS.

South Shields Corporation received five tenders for the supply of two additional electric vehicles for house refuse removal, and have accepted the tender of R. Garrett and Sons, Limited, of Leiston, to supply one 3½-ton vehicle for the sum of £1,697 19s. 3d., and the tender of Edison Accumulators, Limited, London, for one 3½-ton electric vehicle for the sum of £1,783 7s. 6d. The Corporation have applied to the Ministry of Health for sanction to borrow £7,500, the cost of the before-mentioned vehicles and a 3½-ton electric vehicle purchased from Electromobile (Leeds), Limited, at £1,365.

St. Pancras Borough Council have been notified by Messrs. Ransomes, Sims and Jefferies, Limited, that since the Council gave the order for two Orwell electric motor wagons there have been very large increases in the prices of materials in addition to wage advances. They have therefore been compelled to raise the price of their 70-cwt. chassis from £1,200 to £1,400, with a corresponding increase in the price of body work and accessories. They are, however, willing to execute the Council's order at £1,300 for the chassis, leaving the price of the body and accessories as already arranged. The price quoted to the Council for each chassis was £1,200, and the extra cost of the two wagons will be £200. The works committee have recommended the payment of the extra amount.

A year ago Birmingham Corporation ordered 25 electric wagons for the collection of house refuse. In June eleven had been delivered and were in use. When the full number has been received it is expected that every house will be visited once a week. With horse haulage alone and the institution of the 47-hour week it is economically impossible to deal speedily and satisfactorily with house refuse.

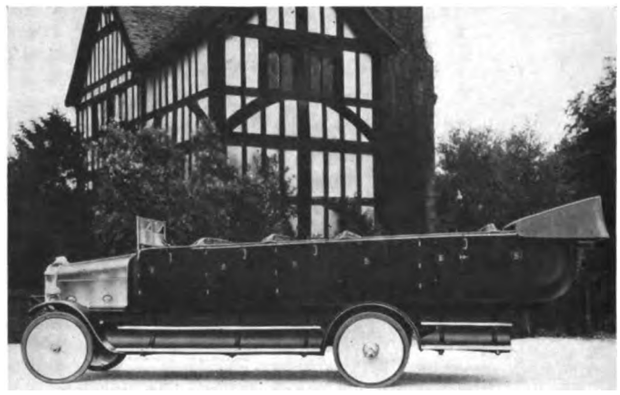
Walthamstow Tramways Committee have accepted the quotation of Electromobile, Limited, for an electro tower wagon for £1,287, plus 5 per cent. for increase of cost since the quotation was given.

Willesden Council have received sanction to a loan for a period of fifteen years in respect of the purchase of electric vehicles instead of as heretofore only seven years.

Johannesburg Council have ordered for their tramways department an Orwell electric tower wagon at a total cost, including charging set, of £2,831.

COACH FOR THEATRICAL TOURS.

The char-a-bancs illustrated on this page was made to the order of a customer in Wales, who, wishing for the best that money could buy, paid the Associated Equipment Company the compliment of entrusting the work to them. Built in their Walthamstow works, it is claimed to be the last word in mechanical perfection, combined with artistic finish, and is sure to attract great interest wherever seen. The owner, who is a well-known theatrical proprietor, intends to use the vehicle for conveying one of his companies from place to place when on tour, and nothing has been spared to make for their comfort. Seat 4, usually fitted traversely in



A.E.C. Coach de Luxe for a Theatrical Company.

bodies of this type, is omitted, and provision is made for a screw-in single pedestal, polished card table, the seats—upholstered in leather being arranged in circular fashion round this. The following brief particulars of the chassis will be of interest:—45 H.P.; seating capacity, 30; plated disc wheels, electric lighting, plated lamps, polished aluminium bonnet; plated Gabriel horn operated by exhaust; body painted in dark mauve. Each panel on the off-side and each doorway on the near side has a gold monogram, and on the rear of the vehicle underneath the hood is depicted the British Bull Dog, rose, thistle, leek, and shamrock in realistic colours.

WHITE CITY MOTOR SHOW.

London is to be given another motor exhibition worthy of the metropolis and the industry which it represents. The exhibition buildings at Shepherd's Bush having been vacated by the Government, makes it possible for the automobile trade to be represented on a scale never before attempted in this country or elsewhere. The Society of Motor Manufacturers and Traders, the governing body responsible for the various shows previously held, have arranged that their members shall have full opportunity of participating in the mammoth display which is to form the first of the exhibitions to be held at the White City.

This innovation does not, however, stop with the motoring industry, as the re-opening of the buildings will inaugurate a further series of exhibitions, representative of the various trades and key industries of the country. These, together with the entertainment programme in preparation, will provide a group of winter palaces where the multitude may congregate amidst congenial and attractive surroundings. One needs only to call to mind the three quarters of a million persons who have in a day been brought to its entrances in order to appreciate the number that can be accommodated next November when the new tube and omnibus services will be in operation.

GOODS TRANSPORT REGISTER.—An industrial vehicle section has been formed in connection with the Automobile Association and Motor Union. Arrangements have been made for the 600 agents of the association to keep a register of goods requiring transport and transport requiring loads. The association has no financial interest in the scheme.

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MOTOR VEHICLES FOR MUNICIPALITIES.

BIRMINGHAM GAS COMMITTEE have decided to purchase a new motor car.

DEWSBURY CORPORATION have decided to purchase a motor lorry for the water department.

LEWISHAM COUNCIL propose to purchase a 20 H.P. 4-cylinder Buick chassis (1915) at £450.

ITCHEN COUNCIL have received sanction to a loan of £1,625 for the purchase of a motor fire engine.

MIDDLESEX COUNTY COUNCIL have decided to purchase a light motor lorry for use during the construction of the sanatorium at Harefield.

EAST HAM CORPORATION have purchased a 15-20 H.P. Rover chassis (1912 model) for £300 and a new brougham ambulance body for £295.

GLASGOW CORPORATION GARAGE COMMITTEE have approved of the offer of Claud Hamilton, Limited, to sell three new Crossley cars for £1,275 each.

BRADFORD ELECTRICITY COMMITTEE have accepted the offer of the Yorkshire Commercial Motor Company, Limited, to supply a steam wagon at £1,300.

GLASGOW PARKS COMMITTEE have agreed to purchase a 2-ton Leyland lorry for £1,092, provided it is found the most suitable for the parks department.

SOUTH SHIELDS CORPORATION have purchased two 5-ton Foden steam wagons at £1,322 each, and have authorised the chief constable to obtain a 25 H.P. hose cart.

ROTHERHAM TRAMWAYS COMMITTEE recommend acceptance of the tender of Railless, Limited, for two new chassis, with worm-driven rear axles, at £1,280 each.

GLASGOW CLEANSING COMMITTEE recommend the purchase of a 5-ton Foden steam wagon at £1,395, principally for the purpose of using in connection with a loading and sweeping machine.

LEEDS WATERWORKS COMMITTEE have accepted a tender for a 30-cwt. petrol wagon, with tipping body, at £000. It is also proposed to purchase a motor car for use in visiting the waterworks estates.

THE METROPOLITAN ASYLUMS BOARD have been recommended by the ambulance committee to purchase fifteen 20-30 H.P. Crossley Royal Flying Corps service chassis from Messrs. Crossley Motors, Limited, for £850 each, less 5 per cent.

SYDNEY (N.S.W.) COUNCIL received from Messrs. Noyes Brothers a revised quotation of £2,325 for the supply of a motor vacuum gulley cleansing machine, but in view of the large increase in price it is proposed not to proceed with the purchase.

PLYMOUTH CORPORATION have accepted tenders as follows:—Straker-Squire, Limited, motor vacuum gulley cleanser, £1,350; Thornycroft and Company, two tipping wagons with inter-changeable bodies, £3,159; Walters and Company, one pioneer sweeper and loader, £485.

PLYMOUTH TRAMWAYS COMMITTEE have received the sanction of the Ministry of Transport to a loan of £30,000 for the purchase of twenty omnibuses, the period of repayment being eight years. The committee have placed an order with the Anglo-American Oil Company for a 5,000 gallon petrol tank.

WALTHAMSTOW COUNCIL propose to purchase a Ford car for the use of the tramways department. The General Purposes Committee have recommended the purchase from H. C. Banley, Limited, of Bow, of three second-hand 5-ton Foden steam wagons, with a spare back axle set, complete, for £3,000.

WILLESDEN URBAN COUNCIL have been informed by the Standard Motor Car Company that the price of the two-seat car on order for the road superintendent has risen from £485 to £545. As the contract provides that the price shall be that ruling at the time of delivery, the General Purposes Committee have agreed to the extra cost.

HAMMERSMITH WORKS COMMITTEE, in recommending the purchase at £761 of a 6½ to 7½-ton water ballast motor roller from Messrs. Barford and Perkins, state that this roller is in every way suitable to the Council's requirements. The one now in use weighs 10 tons, but the borough engineer is in favour of the lighter roller, which is much more suitable for trench repairs, tar-macadam works, etc. For the purposes of comparison, it is estimated that the cost to-day of a new 10-ton steam roller is £1,300 or £1,400.

MANCHESTER CORPORATION OMNIBUSES.

The accounts of the Manchester Corporation Tramways department for the year ended March 31 give statistics with regard to the motor omnibuses, which ran 287,675 miles and carried 2,235,465 passengers. The traffic revenue came to £19,050, which is at the rate of 15·894d. per omnibus mile, and compares with 14·919d. per mile the previous year. The expenditure came to £19,360, which works out at 16·152d. per car-mile, compared with 14·687d. the previous year.

Details of the expenses are as follows, the figures in brackets representing the cost in pence per omnibus mile for the previous year—

	£ s. d.	d.	d.
TRAFFIC EXPENSES—			
Superintendence and other traffic wages	239 14 7	·200	(·200)
Wages of drivers and guards	6,166 10 1	5·145	(2·507)
Bonuses and sick pay	43 12 1	·036	(·040)
Cleaning and oiling	913 4 3	·762	(·719)
Depot expenses	239 14 7	·200	(·192)
Ticket check	431 10 3	·360	(·285)
Uniforms	203 15 5	·170	(·113)
Licences and sundries	97 3 6	·801	(·065)
GENERAL EXPENSES—			
Sundries and wages—administration	263 14 1	·220	(·138)
Rates on depots	119 17 3	·100	(·088)
Printing and stationery	35 19 2	·030	(·023)
Fuel, light, and water	23 19 6	·020	(·022)
Compensation	50 0 0	·042	(·055)
Insurances	35 19 2	·030	(·044)
REPAIRS AND MAINTENANCE—			
Tires	684 9 0	·571	(·530)
Chassis	2,372 8 2	1·979	(1·500)
Bodies	642 9 1	·536	(·255)
Buildings and machinery	71 18 4	·060	(·060)
POWER EXPENSES—			
Petrol	5,472 1 5	4·566	(4·801)

Thus the total working expenses were £18,108, or 15·108d. per omnibus mile, compared with 11·637d. There were no war bonuses this year, but last year this came to 1·674d. per omnibus mile. Depreciation was £1,251, this being 1·044d. per omnibus mile, as compared with 1·376d. for the previous year. The previous year the balance came to ·231d. per omnibus mile.

MOTOR TRAFFIC NOTES.

SHEFFIELD OMNIBUS FARES.—In consequence of the higher cost of running the motor omnibus services, Sheffield Tramways and Motor Committee have arranged to increase the fares.

EVENING TRIPS.—Bournemouth Corporation, having had applications from chars-a-bancs proprietors for facilities for renewing trips, have asked the hackney carriage inspector to deal with the matter.

CONDUCTORS FOR MOTOR COACHES.—Hove Watch Committee suggest that where a motor coach or char-a-bancs carries 20 passengers or over, a conductor must be provided in addition to the driver.

HERTFORDSHIRE OMNIBUS BILL.—Willesden Council are opposing the Hertfordshire County Council Motor Omnibus Bill, in order to secure a clause for the contribution of 1½d. per omnibus mile in respect of road maintenance.

FAILURE OF SYNTHETIC RUBBER.—At a meeting of German rubber factories at Leverkusen, the directors admitted that synthetic rubber could not compete with the real article, either in price or quality, and all the synthetic rubber factories have been closed.

DAMAGE BY HEAVY VEHICLES.—A report of the Ossett Council states that one of the stones covering the beck on the Spa Road was broken by a heavy steam wagon. The stone measured 5 ft. by 3 ft. 5 ins. by 8 ins. thick. Another of the stones covering the beck is cracked and liable to break at any time.

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MOTOR TRAFFIC

PROPOSED PROHIBITION OF METAL TIRES.—Camberwell Council's Highway Committee recommend that the Ministry of Transport be asked to re-introduce the regulation proposed before the advent of the war, by which the use of all metal-shod motor lorries would be prohibited upon the public thoroughfares.

RUBBER TIRES DEMANDED FOR N.S.W. WAGONS.—In consequence of complaints of the nuisance created by the State Metal Quarry steam wagons,and the destruction of roads due to their use, the Sydney (N.S.W.) Council have made representation to the Government with the object of obviating the nuisance by having the tires of the vehicles rubber shod.

PNEUMATIC TIRES ON PUBLIC VEHICLES.—Replying to Viscount Curzon in the House of Commons on June 21, the Secretary to the Ministry of Transport stated that the department was kept informed of the progress of the experiment of using pneumatic tires on omnibuses. The Ministry had not overlooked the possible danger of the bursting of such tires on public service vehicles.

THE IMPORT DUTIES ON CARS.—It was stated in the House of Commons on June 1, that the approximate yield of the new import duties in 1919-20 on motor cars, including motor bicycles and tricycles was £1,021,000, and on accessories and component parts other than tires, £975,000. The commercial vehicle trade is without the aid to reconstruction afforded by import duties.

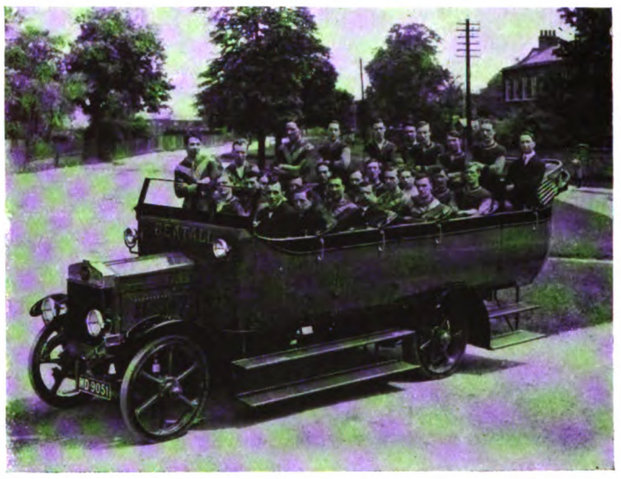
VEHICLE CENSUS AT EXETER.—A census carried out at Exeter in checking the number of vehicles passing certain points during nine hours a day gave the following results :—London Inn Square : motors, 9,000 ; horse-drawn, 5,000 ; bicycles, 17,400 ; others, 3,000 ; total, 34,000. Queen Street : motors, 8,700 ; horse drawn, 4,600 ; bicycles, 17,500 ; others, 3,600 ; total, 34,400.

MUNICIPAL GARAGE FOR LICENSED CARS.—Bournemouth Corporation have decided to allow licensed cars to be placed in the Wharf Road depot at a charge of 1s. a day, the council accepting no responsibility for damage or loss by fire or otherwise. The Hackney Carriage Committee have suggested that chars-a-bancs proprietors should advertise the starting of the cars at the Triangle and elsewhere with a view to relieving the congestion in the square.

TERMS FOR OMNIBUS SERVICE IN SOUTHEND.—Southend Light Railway Committee, which have been negotiating with the Westcliff Motor Chars-a-bancs Company, Limited, regarding a daily omnibus service in the borough and to serve outlying districts, have recommended granting licences on condition that the company pay the corporation in advance £50 in respect of each vehicle licensed, that the company use pneumatic tires on the vehicles on one of the routes, and comply with any reasonable suggestions made from to time by the corporation.

present maximum of 44 hours per week, paying for such overtime worked, or as an alternative additional pay, be authorised on condition that their wagons are under steam and working during the whole time the ordinary workmen are employed. His object in suggesting this is in order to secure where possible an additional journey per day which will have the effect of increasing the earning capacity of each wagon by at least 25 per cent.

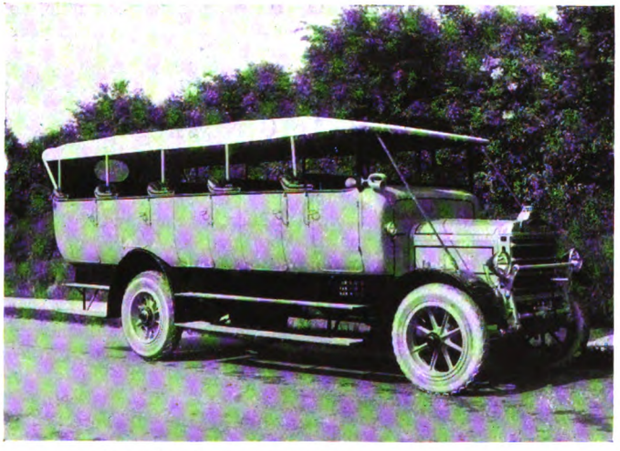
SHEFFIELD OMNIBUSES AND ROAD CHARGES.—The House of Commons Committee which heard the Bill promoted by Sheffield Corporation for powers to run omnibuses in the areas of the West Riding and Derbyshire County Councils decided that matters of



"W. & G." Coach Conveying Football Teams.

road maintenance, etc., should be left to the Ministry of Transport. Counsel for the West Riding County Council contended that in these days it would be ridiculous to suggest three-eighths of a penny per mile towards road maintenance. On behalf of Derbyshire County Council, counsel asked that the Corporation should bear the cost of restoring a road over which the Corporation ran an omnibus service during the railway strike.

MOTOR INSURANCE.—Westminster City Council Finance Committee report that they have received a notice form the Sun Insurance Office, quoting a premium of £288, less 15 per cent. agent's com-



Daimler Coach on Giant Pneumatics.

Inflating Tire by Pump Worked from Lay Shaft of Gear Box.

A DAIMLER COACH ON GIANT PNEUMATICS.—The accompanying views show a Daimler char-a-bancs on Giant pneumatic tires, type C.K. (13 ft. 6 in. wheelbase) chassis, and illustrate the method of filling the tire. The vehicle was exhibited at the Royal Show at Darlington.

TO INCREASE THE EARNING CAPACITY OF WAGONS.—The County Surveyor of Durham has asked the County Council to permit him to employ the steam wagon drivers rather longer hours than the

mission, nett £244 16s., for renewal of third party indemnity policy in respect of the council's 18 motor wagons. The original premium (in 1914) was at the rate of £9 each wagon per annum, less 15 per cent. commission, and the above premium works out at £16 each wagon per annum less commission. In view of the considerable increase of the premium, the committee have instructed the town clerk to inquire whether a policy on lower terms can be obtained through Lloyds.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

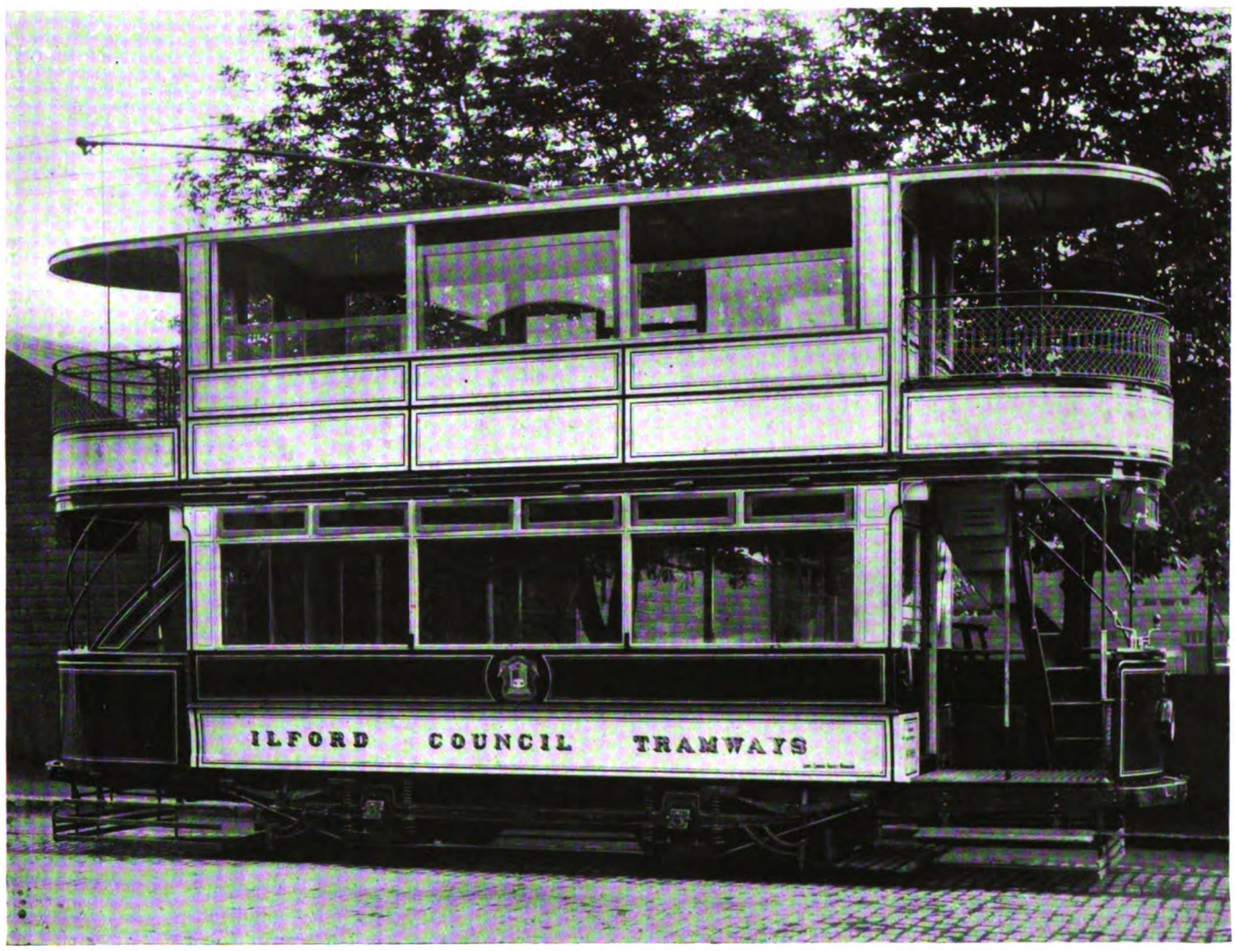
Founded 1892. LONDON, AUGUST 19, 1920. VOL. XLVIII.

NEW CARS FOR ILFORD COUNCIL TRAMWAYS.

NOTABLE IMPROVEMENTS IN DESIGN AND FITTINGS.

When the Ilford Council Tramways were opened in March, 1903, the department had 18 cars. Four more were bought in 1904, and an additional four in 1909, while in 1916 two second-hand cars were bought from Barking Council, making a total of 28 cars. Eighteen of these cars are now sixteen years old, and the loans upon them have been repaid. Most of them are in such a condition as to be no longer repairable, and in March, 1919, the Council decided to purchase six new cars, and later ten additional cars were ordered. The first six new cars were recently delivered, and it is hoped that the remaining ten will be ready for service by the end of the year. The new cars are of specially strong construction, and are designed to withstand the heavy loads now carried. They embody also the latest improvements, and are particularly neat and comfortable vehicles. Their cost is about £2,062 each.

The accompanying illustration gives a perspective view of one of the new cars, which have been constructed to the specification of Mr. L. E. Harvey, manager and engineer of the Ilford tramways. The bodies and trucks were built by the Brush Electrical Engineering Company, Limited, of Loughborough, and the electrical equipments were supplied by the British Thomson-Houston Company, Limited.



Ilford Council's Standard Car.

The seating capacity is 64, the lower saloon providing

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accommodation for 26 passengers and the upper saloon for 30, the canopies at each end seating four passengers each. The principal dimensions are as follow—

Length of body over corner posts ...	18 ft. 6 in.
Length of each platform	5 ft. 6 in.
Length over platforms	29 ft. 6 in.
Length over buffers	30 ft. 6 in.
Width of lower saloon over pillars	6 ft. 8 in.
Width of upper saloon over pillars	7 ft. 0 in.
Width over roof	7 ft. 0 in.
Clear height at centre of lower saloon	6 ft. 9 in.
Clear height at centre of upper saloon	6 ft. 4 in.
Height of doorway, lower saloon ...	6 ft. 1 in.
Height of doorway, upper saloon . .	6 ft. 0 in.
Width of doorway, lower saloon ...	2 ft. 0 in.
Width of doorway, upper saloon ...	2 ft. 0 in.
Overall height over trolley plank ...	16 ft. 6 in.
Gauge	4 ft. 8½ in.
Wheel base	8 ft. 0 in.

The underframe is of mild steel channel lined with teak, the crossbars being of oak secured by knees. Crossbars taking the platform bearers are of mild steel channels lined with pitch pine, and are bolted to the side frames. The platform bearers are of mild steel section, and are bolted to the head stocks and to the steel crossbars of the underframe. Life guards of the Hudson-Bowring type are provided.

The lower saloon has three windows on each side, with six ventilator windows above each hinged at the end, and over these are six air extractor ventilators. The upper saloon is similarly constructed. In both upper and lower saloons, at diagonal corners nearest the stairs, are casement windows fitted with hinges and gripfast fasteners. Fixed windows are placed in the corners opposite. The window frames are of oak, those in the upper saloon being fitted with Laycock's patent balanced springs, and each window is movable up or down independently. The doors in the upper and lower saloons are of oak, with glass panels in the upper portion and oak in the lower panels. They are hung on Laycock's patent ball-bearing runners, and are fitted with Kaye's locks. The ceilings are of stout aluminium sheet in three panels. All interior mouldings are of oak of simple design, so as not to harbour dust or dirt. The interior of the lower saloon is provided with two grab rails. Conductor bells are fitted on the canopy at each end, and are of the single stroke mechanical type, actuated by a round leather cord running through the lower saloon at each side.

The corner and window pillars are of teak, with knees to the floor. The roof is of ⅝ in. pitch pine, tongued and grooved and covered with standard roof canvassing. The waist and end panels are of ⅜ in. mahogany, and the rocker panels and side boards of ⅜ in. Canadian white wood. All the panels are well secured to the frame, canvassed and glue-blocked to rib rails and posts. At the back of the top and bottom of the panels, running their whole length, are strong trusses of 2 in. by 1½ in. wrought-iron. These trusses are screwed to the panel ribs and posts where they cross. The door pillars are specially supported with U irons to the end sills.

A useful innovation are the seats of the Rayner patent "Kleencar" type. In the lower saloon the seats are hinged longitudinally, and in the upper saloon they are of the garden seat type with reversible backs. The seats in the lower saloon are supported on legs, and are hinged to the side of the car, against which they can be folded back leaving the floor from side to side wholly unobstructed, so that the cleaners can do their work easily and thoroughly. Another advantage of the new seat is that it gives more space in the car for passengers' feet, and provides room under the seat for parcels. Sand-boxes are placed at the ends of the seats in the lower saloon, but are so arranged as not to interfere with the patent seats. The sanding is effected by Taylor's patent intermittent type.

Destination indicators are fitted at each end under the canopy bend, and a headlight is fixed in each dashboard in addition to the side headlight. Six lamps are placed in the lower saloon and five in the upper, two lamps in the lower saloon being in series with three in the upper saloon, and three in the lower saloon are in series with the remaining two in the upper saloon. The sixth lamp in the lower saloon is in series with each destination indicator. Both platform and headlights are so arranged that the front headlight is in series with the two front side lamps, the rear red light and the lamp fixed to the under side of the rear canopy. This series has a change-over switch to operate a similar series when the car is running in the reverse direction. A main circuit switch is fitted under the canopy at one end of the car, and at the other end is an automatic circuit switch capable of protecting the motors from excessive current. Holophane globes are used in the interior of the saloons, and the lamps have been placed so as to be out of the way of passengers and to give a diffused light.

Under the stairs at one end of the car is fitted a locker made of teak, and at the other end are resistances of the E.M.B. type, made by the Electro Mechanical Brake Company.

The trucks are of the Peckham Truck and Engineering Company's pendulum type, with 8 ft. wheel base. In this truck the pendulum gears that support the side frames upon the axle boxes consist of independent lingitudinal supporting frames suspended flexibly from the truck by means of inverted U-shaped saddles. The effect is to increase the wheel base of the truck 2 ft., and to permit the wheels and axles to move laterally independent of the side frames.

The axles are of special mild steel of 4½ in. diameter, and the wheels are pressed on by hydraulic pressure of not less than 30 tons. The wheels are of Siemens-Martin acid steel, with an outside diameter of 33 in. Hand brakes of the Peacock patent type are provided, together with Thomas's patent brake rod adjuster.

The motors are of the British Thomson-Houston G.E. 200 split frame, form C, ventilated interpole type, of 35 H.P., and the controllers are of the British Thomson-Houston type K 10. Gears and pinions are of tooled steel.

The cars are painted sage green and cream, with plain lines, and are very neat and attractive.

LONDON TRAMWAYS AND OMNIBUS INTERESTS.

COMMITTEE REPRESENTING L.C.C. AND UNDERGROUND GROUP.

The Minister of Transport has announced that at the request of the London County Council he arranged a conference between their representatives and the representatives of the Underground Group of companies, to discuss the relationship between the London County Council Tramways and the other forms of London traffic, with the object of seeing whether it is possible to arrive at an agreement for co-ordinating and improving transport facilities in London.

As a result of the conference it was decided to set up a committee on which representatives of both sides will sit, with the object of discussing the subject in its widest aspect. The Minister suggested an outside chairman, but both parties requested that the Minister should allow an official of the Ministry to act; and Sir Alexander Gibb, who has acted as chairman of the Technical Sub-committee of the Advisory Committee on London traffic, was accordingly appointed. The following members of the Council have been appointed to represent the Council at the conference—Messrs. A. A. Allen, J. M. Gatti, H. H. Gordon, G. H. Hume, J. Speakman, W. J. Squires.

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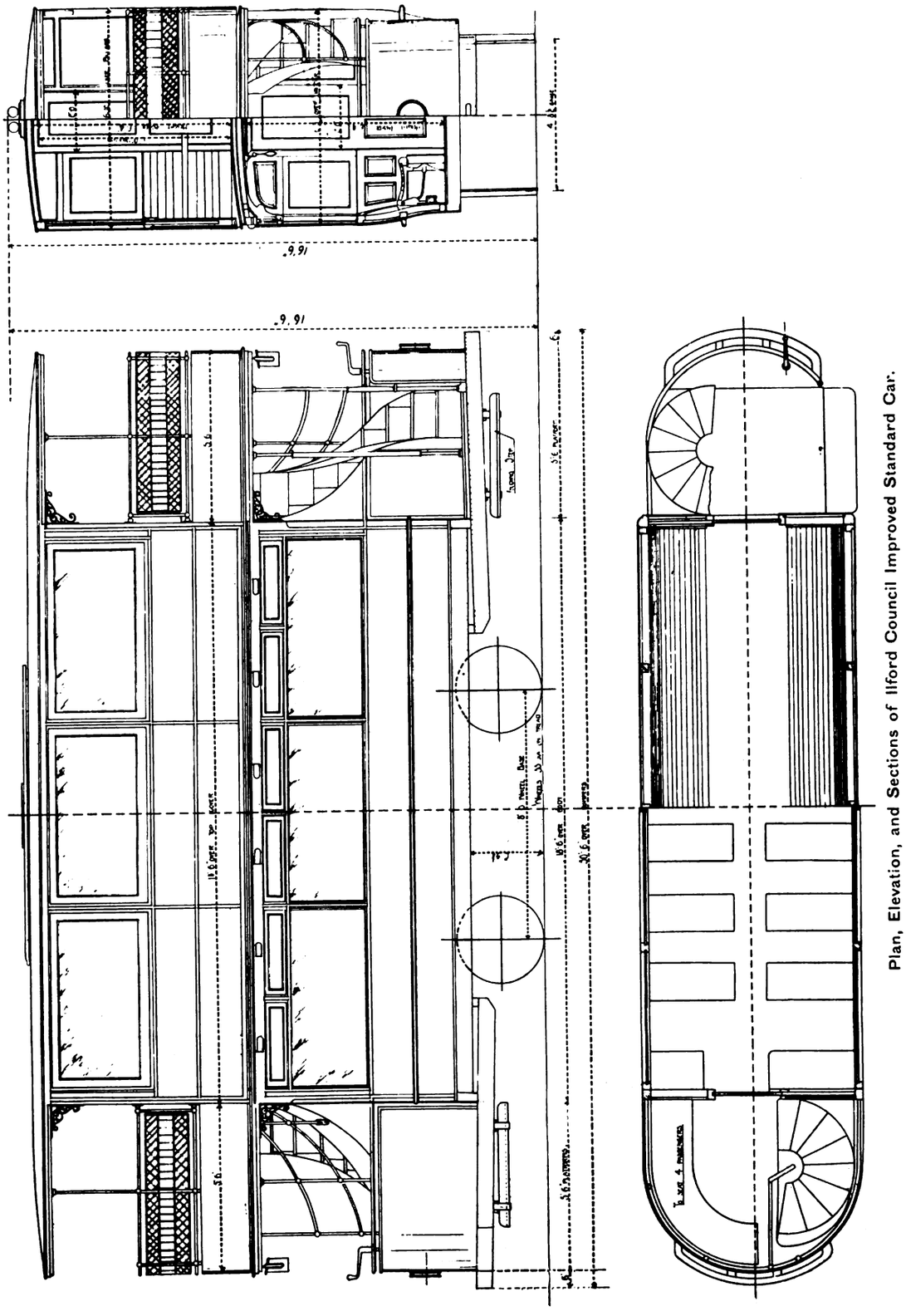

Plan, Elevation, and Sections of Ilford Council Improved Standard Car.

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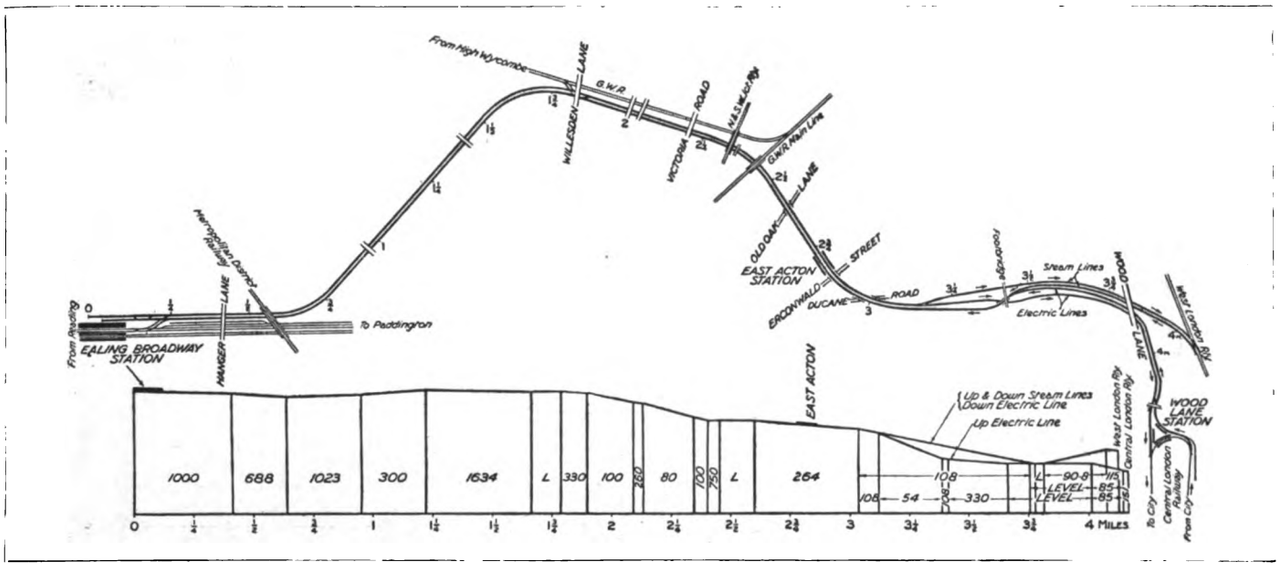
THE EALING AND SHEPHERDS BUSH ELECTRIC RAILWAY EXTENSION.

THE GREAT WESTERN AND THE CENTRAL LONDON RAILWAYS PROVIDE AN IMPORTANT ADDITION TO LONDON'S TRAFFIC FACILITIES.

The Ealing and Shepherds Bush Railway, which was opened for traffic on August 3, is in effect an extension of the Central London Railway, and enables that Company's trains to run through from Liverpool Street Station to Ealing. A new route is thus provided between the City and a western suburban district that will afford relief to the excellent service of the Metropolitan District Railway, which at certain hours is now severely taxed by the ever growing traffic. The extension was authorised by the Great Western Railway Act of 1911, and its construction was begun in the following year. Good progress had been made with the work by August, 1914, when the outbreak of war put a temporary stop to construction. Since the armistice, however, both the Great Western and the Central London Railway have done everything possible to hasten completion, with a result that is highly creditable to both companies.



Ealing and Shepherds Bush Railway—Route and Gradients.

The new line, which is 4 miles 22 chains in length, forms a connection with the West London line near Uxbridge Road, and is available for use by the Great Western passenger and goods trains; and goods traffic was conveyed over it by steam trains for some time prior to the commencement of passenger traffic on August 3.

The location and gradients of the new line are shown in the accompanying diagram. Starting at Ealing Broadway, the western terminus, the trains run entirely in the open to Wood Lane Station, when they enter the tunnel, through which they proceed to Liverpool Street Station, the whole distance being about 10 miles Two new platform lines have been constructed at Ealing Broadway between the Great Western and the District Stations, and there is here a spacious island platform with verandah covering. A little beyond the platform is the double junction with the Great Western line, and the new line runs parallel with this for about half a mile, after which it turns northwards towards the Great Western London and Birmingham line, with which a double junction has been constructed, giving access, *via* the West London line, to railways south of the Thames. From this junction the line continues in a south-easterly direction to Old Oak Common, running underneath the Great Western lines at that point, passing a new station at East Acton, and proceeding along the west side of Wormwood Scrubbs to Wood Lane Station. Some distance before reaching this station the up line passes under the down line and continues on the right hand side to the station, where are new platforms for the trains that pass over the extension.

The third rail system as used on the Central London Railways has been installed on the extension, the positive conductor rail being laid in the centre of the track, and the track rails serving as the return. From Park Royal power-station of the Great Western Railway current is transmitted to the conductor rail through the sub-station at Old Oak Common, the cables being carried along the track on concrete posts. In the sub-station are motor converters taking alternating current at 6,600 volts and supplying direct current to the line at 600 volts. In the sub-station is also a battery with a capacity of 700 KW.H. at the one-hour rate. In addition to the supply for traction purposes there is also a single-phase supply at 460 volts for electric signalling.

The working of the trains is safeguarded by the provision of automatic signalling, the line being divided into sections, eight on the down road and nine on the up road, the longest section being about 1,100 yards, thus enabling a service with the minimum of interval being run when necessary. There are three signal-boxes, one at Wood Lane Junction, which controls a fly-over junction connecting the West London and West London extension lines to Addison Road and Clapham Junction. The signal-box works the facing points of the junction mechanically, and electrically controls the necessary signals for the protection of the

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View East from Ealing Broadway—Junction with Great Western Line.

Up Train Arriving at East Acton Station.

EALING AND SHEPHERDS BUSH ELECTRIC RAILWAY.

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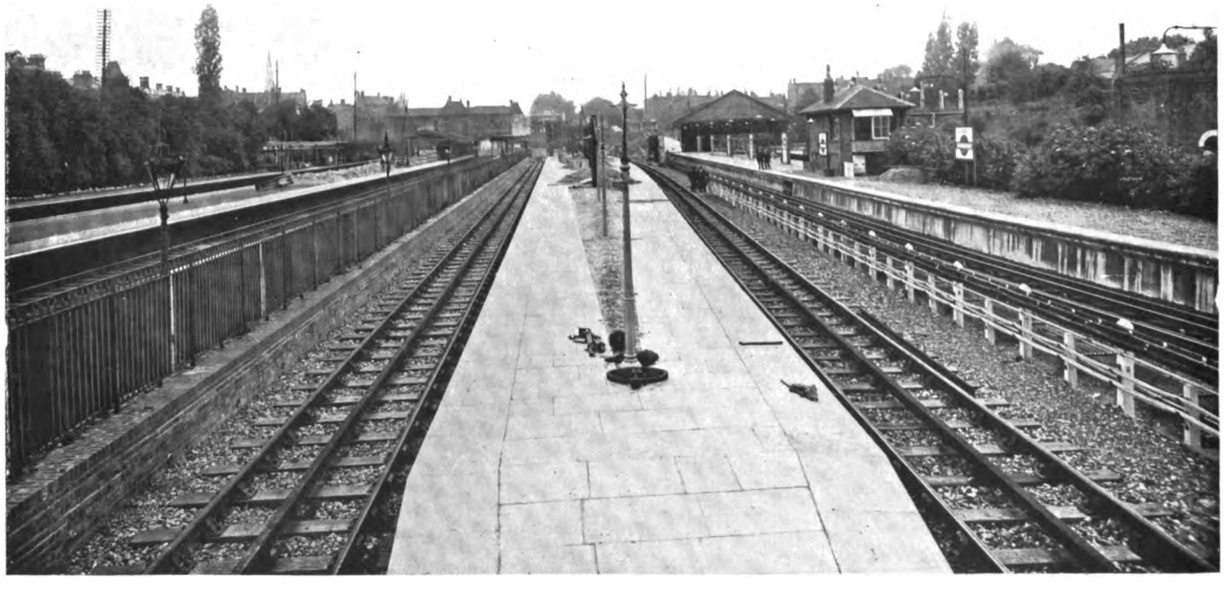
junction. The North Acton box controls the junction between the Ealing and Shepherds Bush line, and the Great Western direct line to Birmingham. The interlocking apparatus required for the new terminus of the Ealing and Shepherds Bush Railway is operated from the District Company's box, and is of the electro-pneumatic type, there being six sets of points. All signals are of the three-position type, worked in the upper quadrant, which are controlled by alternating current track circuits, and give the following indications—Horizontal, red light, danger; 45 degrees, yellow light, proceed with caution; vertical, green light, proceed at normal speed.

These signals are put to "danger" on the passing of a train, and do not again alter in position until the train has cleared the track circuit of the section ahead, when the signal arm works automatically to the 45 deg. position. Upon the train clearing the second section ahead the signal assumes the vertical position. At the junctions the signals are controlled by the signaller in addition to the track circuits.

A Typical Bridge seen from Rail Level.



Ealing Broadway Station.

L.C.C. Housing Scheme in being at Old Oak.

In each signal-box there is an illuminated diagram by means of which the signalman is able to follow the movements of trains over the sections of line applying to the signal-box. At each signal a train stop is provided working in conjunction with the signal arm, which on being passed in the "danger" position automatically applies the brake on the train. For foggy weather repeating light signals are provided throughout the line at a distance of 200 yards from the signals. These are lighted when necessary by means of switches.

The work has been carried out by the McKenzie Holland and Westinghouse Power Signalling Company under the direction of the signal engineer of the Great Western Railway.

Rolling Stock.

The trains consist of six cars, two motor cars, and four trailers. The latter are standard Central London

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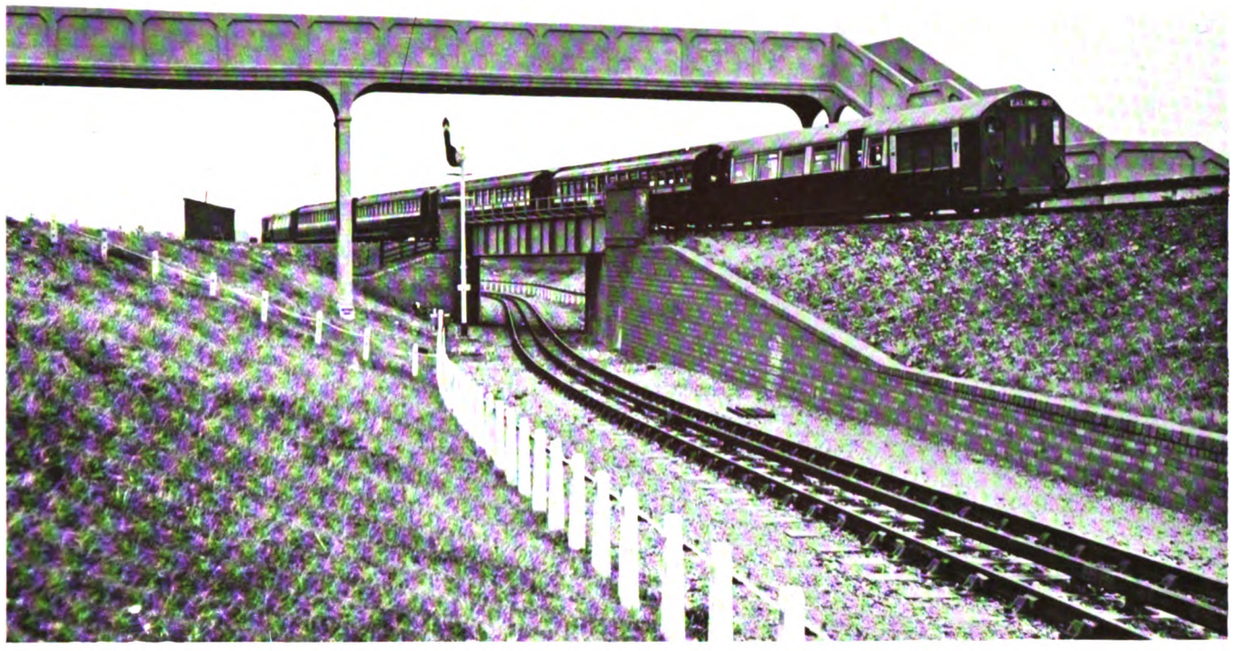
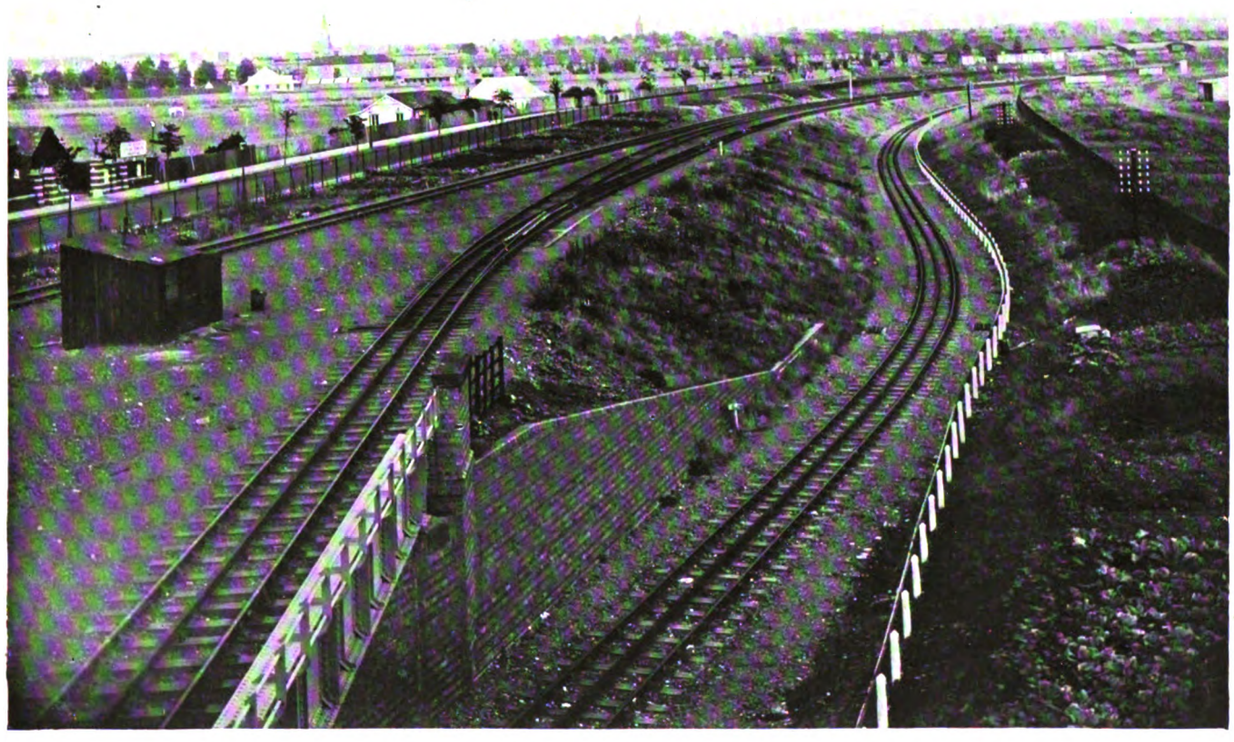


Up Train on the Fly-over Junction West of Wood Lane Station.



Fly-over Junction.

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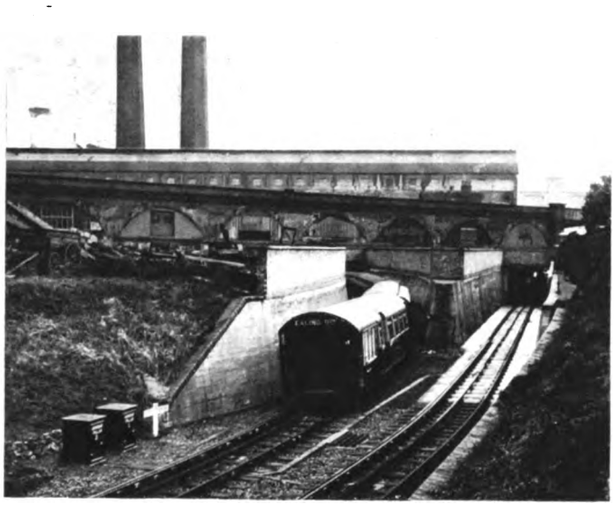
Railway Stock, while the motor cars have been specially designed for this extension.

The control equipment supplied by the British Thomson-Houston Company is of the relay automatic type. The normal position of operation with this system is to place the controller at once to the full on position when starting a train. The contactors are then picked up in their correct sequence by the current limiting relay, which operates as soon as the motor current has dropped to a predetermined value. The relay consists of two shunt and one main coil. The latter carries current equal to that of one motor only. The actuating coils of the contactors are energised through one or other of the two shunt coils in a manner such that, if one is energised through one shunt coil the next one to close will be energised in series with the other shunt coil. The two relay shunt coils act on two plungers controlled by gravity. Each plunger, when in its normal position, closes a disc switch in series with the other shunt coil; but when raised (due to its coil being energised) opens this switch. Thus, when one of the plungers is raised the shunt coil acting on the other cannot be energised because of the break



Down (left) and Up (right) Lines connecting Ealing Extension Line with Central London Railway at Wood Lane.

in the circuit produced by the above-mentioned switch, but although it is the control current that raises the plunger so as to produce this break, it is the current passing through the main coil which maintains the break, and the plunger is not released until this current has dropped to the pre-determined value. Then the plunger falls and closes the switch, which completes the circuit for the next contactor coil to be energised.

The principle underlying the method of control adopted in connection with the current limit relay is that after a contactor has been picked up, as described above, its coil is immediately transferred (by means of inter-locks) to another wire. There are thus essentially two operating wires, the picking up wire and the retaining wire, although other wires are introduced for forward and reverse, circuit breaker setting, etc. As there are no main bus lines down the train, a potential relay is fitted on each motor car, which drops all contactors on that car when the motors lose current. This is necessary, because when no current passes through the main coil of the current limit relay it ceases to exercise its control over the rate of picking up of contactors.

The controller has four forward points and two reverse (series only), of which Nos. 2 and 4 are running points, where all resistance is cut out. A useful provision in the control is that if in the course of the automatic notching up the controller handle is brought back to the first or third notch as the case may be the automatic closing of contactors is stopped, but those already closed are kept up. The working on the safety button on the controller handle differs from the Central London Railway standard in that the safety button can be released, except when the handle is at off position. If, however, the handle itself be let go, it flies back to off position, when current is instantly cut off and the brakes applied throughout the train. Another safety device is the control circuit governor. By interrupting one of the control circuits it prevents the train being driven forward unless the train pipe of the Westinghouse brake is charged with air and the trip cock is cut in.

Each motor car is fitted with two GE212 motors of 240 H.P., geared for a free running speed of 35-40 miles per hour. The brake equipment is Westinghouse, with improved triple valves on the motor cars and quick acting triple valves on the trailers. The brake blocks are of unchilled cast-iron. The air compressor is of the B.T.H.C.P. 28a type. The motor cars are provided with a covered vestibule at the trailing end, and middle doors have been fitted. The control of the latter is similar to that previously described in connection with new stock for the Queen's Park extension on the London Electric Railway.

The interior steel panels of the motor cars are painted a light brown to tone with the colour of the moulding, etc., which are of teak or steel, painted to match. The lamp fittings and ends of cross seats are finished in oxidised bronze; other fittings are of aluminium alloy. The ceiling of the arched roof is agasote, enamelled flat white. With regard to ventilation, in addition to the ordinary drop lights, an air duct with perforations runs the whole length of the motor car, and is open to the air at the ends. The motor cars are constructed mainly of steel, with some teak interior finish.

The sole bars consist of 12 in. +4 in. +6 in. bulb angles, upon which the body framing is built up. The motor trucks are built up of plate and angle iron, and the trailer trucks of pressed steel sections. They are fitted with the ordinary laminated side bearing springs.

The motor cars were constructed by Cammell Laird and Company, Limited, from diagrams drawn at the Ealing Common Drawing Office of the Underground Companies.

The leading dimensions and weights are as follows—Length overall, 47 ft. 9 in.; width over body, 8 ft. 9 in.; total height from rail, 9 ft. 3½ in.; centres of bogies, 29 ft. 6 in.; diameter of motor wheels, 36 in.; wheel base of motor bogie, 6 ft. 8 in.; diameter of trailing wheels, 29 in.; wheel base of trailer bogie, 5 ft.

The weight of the car completely equipped is 22½ tons at the motor end, 9½ tons at the trailer end; total weight, 32 tons. The total weight of the six-car train (unloaded) is 128 tons.

Rolling Stock for New South Wales.—The New South Wales Railway Commissioners have under construction 100 corridor suburban carriages of a new type, which are in anticipation of the inevitable electrification of the railways on both the Sydney North Shore and main suburban lines. The new carriages are being so built as to be readily convertible. They are nearly a foot wider than the ordinary suburban corridor car. Provision is made for three passengers on one side and two on the other, as against two on each side to-day.

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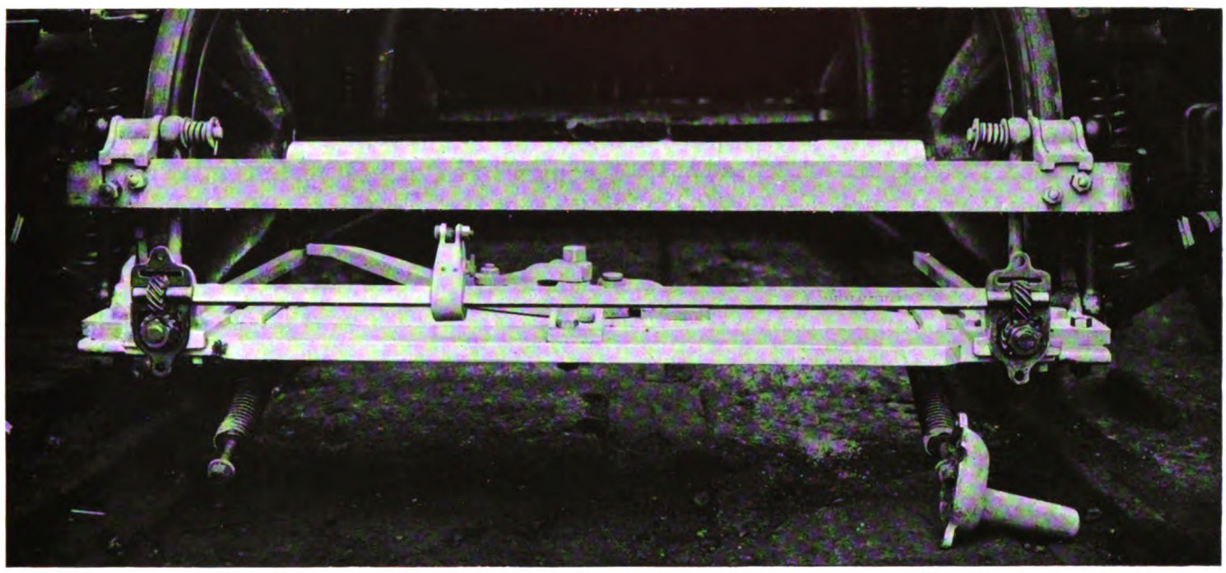
"THOMAS" BRAKE ADJUSTER.

Many attempts have been made to design brake adjusters for tramway and railway vehicles, most of which are of the "automatic" type, but it has been found from experience that these give trouble in actual use owing to the fact that, when the cars are loaded, the springs settle down, thereby allowing the brake shoes to fall away from the wheels. The "automatic" device then comes into use, and adjusts the brake shoes up to the wheels. When the car reaches the terminus or when the load is taken off it is found that the brake shoes are hard up on the wheels, owing to the springs having assumed their normal height.

The device shown here has been designed and patented by Mr. S. Thomas, engineer of the Peckham Truck and Engineering Company, Limited, of 10, Coleman Street, E.C.2, to overcome this trouble, and also to obviate the necessity of either sending the car into the depot or having a man sent from the depot when the brakes are reported to be unsatisfactory by the driver, either of which involves a considerable loss in time and revenue.



The Thomas Brake Adjuster.

It will be seen that with this device the inspector at the terminus can adjust the brakes (when reported by the driver to be bad) without any delay to the car. It also saves a considerable time in the car sheds, as the man attending to the adjustment of brakes can get round a much larger number of cars, and it is always assured that the brakes are adjusted evenly on all wheels. This device is so designed that it is impossible for the brake shoes to be adjusted so as to bind the wheels, and it is arranged to slacken off the nuts on the brake rods evenly when replacing the old shoes with new ones.

This gear can be fitted to any type of truck, including maximum traction or equal wheel bogie trucks. It has been tested thoroughly for a considerable time, and reports from users show that it works in a very satisfactory way.

It is claimed that the advantages of this device are as follow—

(*a*) That it adjusts all brake shoes evenly and simultaneously (according to wear) so that all the brake shoes are up to the wheels, thereby ensuring perfect braking of the car.

(*b*) That it is so constructed that it is impossible to adjust one pair of brake shoes without adjusting the other.

(*c*) That it is impossible to adjust the brakes so that the shoes are bound tight against the wheels.

(*d*) That the adjusting mechanism is entirely encased in dust-tight grease box, and it is always free from dirt.

(*e*) That once adjusted it is not necessary to readjust the brake gear every time that the old brake shoes are replaced with new ones, as the nuts on the brake rods are slackened off evenly.

To renew worn out brake shoes it is only necessary to release the pawl of the ratchet lever on the adjuster shaft, then turn the adjuster shaft, and put (towards the truck) with a spanner. This will slacken the brake shoes from the wheels evenly, when the old shoes can then be replaced with new ones. The ratchet pawl is then allowed to fall into position again. The pull-on lever at the end of the car is actuated a few times to bring the shoes into position, i.e., $\frac{1}{8}$ in. or $\frac{1}{16}$ in. from the wheels as desired.

A large number of these brake adjusters are on order for various tramways in this country, and the Peckham Truck and Engineering Company, Limited, will be pleased to supply drawings and any other information upon application.

Ventilated B.T.H. Traction Motor.—The British Thomson-Houston Company, Limited, have issued a 12-page pamphlet (descriptive list No. 8,027) on "Ventilated Traction Motor, Type G.E. 200-K." The pamphlet contains a full description of the motor with numerous illustrations and also drawings, showing the construction and the mounting of the motor. While the motor has been designed for standard gauge, it can easily be adapted for one of 4 ft. It is of the ventilated interpole type, and embodies features which have been found most suitable for present-day requirements. Since the introduction of the ventilated type of tramway motor for all conditions of service, such satisfactory results have been obtained from it both as regards reliability and cost of maintenance that the ventilated motor is likely to supersede the enclosed type. As all parts of the motor, including the interior of the armature core, are cooled with air at atmospheric pressure, the motor is capable of being run continuously with a higher output, and for a given service it can be made both smaller and lighter than the enclosed motor. A list of some thirty-four British undertakings to which the British Thomson-Houston Company have supplied ventilated traction motors is given in the pamphlet.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, AUGUST 19, 1920.

Liverpool Omnibus Revenue.

No discouragement should be felt by Liverpool Tramways Committee at the loss of £5,000 on their omnibuses during the past year. Nine routes enjoyed the advantage of the services, and the fact that on five routes the revenue ranged from £45,000 to £128,000 shows that the enterprise supplied a want. With the London omnibuses experiencing a heavy loss on their present inadequate fares, which cannot be revised until the railway fares of the Underground Group have been increased under the new powers granted by Parliament, the loss at Liverpool is not serious. The remedy is indicated by the tramways committee, who state that omnibuses with the present seating capacity cannot be operated remuneratively on the present fares. Steps should therefore be taken as soon as possible to increase the charges, besides adopting new experimental routes. One suggestion put forward by the committee is that the vehicles should be used at a special rate of fare to relieve the tramway cars of long distance passengers. Provided that the omnibuses give a more rapid service this plan should meet with success, while enabling the cars to provide a more frequent service in the inner districts. Although the tramways have their own car works, the management no doubt find that the slowness of the return to normal conditions is a handicap to the provision of more cars to deal with traffic during the busy periods. The committee are losing no time in the trying of new routes. One scheme, which was inaugurated towards the end of last month (July) provides a ten-minutes' service linking the chief railway stations with the Pier Head, the traffic centre of the city. The heart of the city will thus be encircled by an omnibus service giving facilities not provided by the tramways. Moreover, such a service has been asked for by the public. With judicious advertising and adequate fares these innovations ought to achieve success.

Further Fare Increases.

The experience of London County Council and Manchester Corporation with increased tramway fares conveys a salutary lesson. The revisions effected early in the year in London, and a few weeks ago in the case of Manchester, are insufficient to meet the increased working costs. The continual rise of operating expenses has necessitated three revisions of fares in London in three years, and only if there is no further increase of working expenses will the present changes suffice to meet the outgoings. The changes are startling when it is recalled that before the 1917 revision a distance of nearly a mile could be traversed for one halfpenny and more than two miles for one penny. Now the average distance for 1d. will be only six-tenths of a mile, as against one mile and one-fifth at present and two miles in 1917. For 2d. a passenger will be carried 1·8 mile, as against 2·5 miles and 4½ miles three years ago. Given in sections, a penny fare franks one section; 1½d., two; 2d., three; 3d., five; 4d., eight; and 5d., twelve sections, or just over seven miles. Any further distance on one car will be 6d., with a revival of certain transfers to enable a passenger to reach a central terminus for the fare, subject to only one change being made. Notwithstanding that another revision has been made in workmen's fares, which are issued to any persons travelling before 7.20 a.m., the early morning charges are still too liberal for those of the working classes whose wages are far in advance of those paid to many of the later

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travellers. Workmen will be able to travel 14·4 miles return, any further distance being only 6d. return. The cheap maximum fare of 2d. during the slack hours is to be continued. Since its institution this innovation has not brought so large a revenue as was anticipated, but when the revision of the other fares takes effect on September 25 there will perhaps be sufficient of the fine weather period left to enable the management to determine whether the arrangement is worth retention. Manchester's recent revision left car riders in possession of a cheaper ride than is given by the scale about to be displaced in London, namely, 1·5 miles for a penny, as compared with 1·2 miles. The increase in receipts has not been sufficient to meet the enhanced cost of working, and a further revision is expected. Thus it is clear that tramway authorities should adopt a courageous course, for no hope can be entertained of a material fall in expenses. Present indications point, indeed, in the opposite direction.

Enterprise at Belfast. Concurrently with restoration of the tramways undertaking to a satisfactory financial basis, the Belfast Tramways Committee and Mr. J. S. Moffet, the present general manager, have had the satisfaction of opening the Bellevue Gardens. This place came into the possession of the Corporation when they took over the Glengormley tramway before the war. At that time the gardens comprised steep slopes of quarry rubble in the midst of 34 acres of beautiful scenery. Mr. Andrew Nance, then the general manager, tackled the task of converting the site into a pleasure garden, and a sum of £40,000 was spent on engineering work to prevent the place, as its opponents said, slipping into the lake. A landslide interfered with the operations and then the war put a temporary stop to the enterprise. Mr. Nance's faith in the scheme has been justified, and although ill-health prevented him attending the opening ceremony on July 11, he must have read with pleasure the encomiums passed upon what Sir C. M'Cullagh described as the dream of Mr. Nance's life. The realisation of that eminently practical dream forms, indeed, a fitting conclusion to the many years of successful tramway management that Mr. Nance gave to Belfast. The Lord Mayor, in declaring the gardens open; Councillor Turner, chairman of the tramways committee; and Sir Crawford M'Cullagh agreed that Bellevue and its surroundings stand without a rival for beauty in the United Kingdom, the Lord Mayor predicting that those who at first opposed the expenditure would change their opinion on seeing the place. As for the expenditure upon the scheme before the war, Sir Crawford scored when he observed that if the Parks Committee had the work to do now it would cost four times the amount. The present chairman of the tramways committee has been one of the members who shared the foresight of Mr. Nance in regard to the capabilities of the place as a revenue producing asset, and he has found a supporter in Mr. Moffet, who has provided a special service of cars to enable the citizens to enjoy Bellevue's floral and scenic beauties and band performances. Amusement parks are an outstanding and successful feature of American tramway enterprise, and in the opening of Bellevue the committee have provided the population of their great city with an attraction which they should not be slow to take advantage of. In the happier times to come, when more visitors than ever before will visit the Emerald Isle, the management will only have to bring to the attention of English people the Lord Mayor's assertion that a more charming view is not to be seen in the United Kingdom or abroad to induce them to add to the earnings of the Bellevue Tramway.

Restrictions on Traffic. If there is one thing more than another upon which experts are agreed it is that the flow of traffic should not be artificially restricted. Apparently the technical committee of the Ministry of Transport are of the contrary view, or at any rate are experimenting in that direction. During the latter part of the war the shortage of labour and rolling stock led to the closing of many stations of the steam railways in the London area. During the past twelve months unsuccessful attempts have been made to secure the reopening of the stations. To the Lambeth Council's request for the reopening of Brixton Station the Ministry replied that they could not recommend that course. When asked, in an

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interview with the Town Clerk, to state their reasons, an official informed him that it was the general opinion of the committee that short distance traffic, such as that from Brixton to the City and the West End, should be dealt with by omnibuses and tramways, leaving the longer distance traffic to the railways. Further, it was stated that if this policy were finally adopted, it was possible that the stations on the main lines within a distance of five miles of the various termini would be closed to local traffic. Whether the local authorities and the public will accept such a permanent curtailment of travelling facilities is very doubtful. It remains to be seen, too, whether the railway companies will acquiesce in the scheme. While it is admitted that the suburban steam traffic has been reduced since electrification of the tramways, it is also certain that the motor omnibus has deprived them of a good deal of traffic. Yet railway chairmen have never complained that their local traffic has to be worked at a loss, which would be the only justification for refusing local traffic in normal times. The question of electrification, too, must be taken into account, for electric working in the cases of the L.B. and S.C. Railway and the S.W. Railway has resulted not only in the restoration of the lost traffic but in a great augmentation. Consideration must be given to the views of the tramway and omnibus undertakings. For one thing the channels of road transit in the five-mile area are working at saturation point during the rush periods. Again, tramway termini are far removed from the West End, in which the result of the restriction would be to throw much extra strain upon the omnibuses and underground railways. Another point is that the limit has been reached in the amount of traffic which the streets are capable of carrying. Above all, it is advisable that the public should not be inconvenienced by depriving them of a more speedy means of transport, and one that is not subject to the many risks of breakdown and obstruction attaching to road vehicles. There might be some justification for the deprivation if London were a new city with streets and railways planned on scientific lines. As it is there is not even equality of transport facilities in the various districts.

METROPOLITAN MUNICIPAL TRAMWAYS COUNCIL VISIT TO PORTSMOUTH.

FORMER MINISTER OF LABOUR'S ADVICE TO TRAMWAY EMPLOYEES.

On July 16 the Metropolitan Municipal Tramways Council and a few guests visited Portsmouth. The party were met at the station by Mr. W. R. Spaven, the general manager of Portsmouth Corporation Tramways, under whose guidance they were conveyed by an open car to Cosham, where arrangements for the rapid unloading and loading of cars were examined with interest. On the return journey the tramways depot and well-fitted repair shops at North End were inspected. Here a new type of watering car, designed by Mr. V. G. Lironi, the engineer, attracted much attention. The party then proceeded to the Town Hall, where they were entertained at luncheon in the banqueting room by the Mayor, Councillor John Timpson, who is also chairman of the Tramways committee.

Following the loyal toast, the Mayor proposed "The Metropolitan Municipal Tramway Managers," to which toast response was made by Mr. A. C. L. Fell, C.B.E. (London County Council) and Mr. T. B. Goodyer, hon. secretary of the Council and general manager of Croydon Corporation Tramways.

The Rt. Hon. H. G. Roberts, P.C., M.P., formerly Minister of Labour, proposed "Prosperity to the Town of Portsmouth." He expressed agreement with previous speakers' remarks that unless transport was efficient and economical every form of business would be hampered. Adverting to what he termed the despondent view taken by Mr. Fell as to the work of the Industrial Council set up in connection with the tramways industry, he said he shared that disappointment, because it was his responsibility, whilst acting as Minister of Labour, to help start the Industrial Councils. He addressed a meeting at the Mansion House, at which it was his duty, on behalf of the Ministry of Labour and the Government, to advocate their formation in connection with municipal and private tramway undertakings. They did not contemplate that those bodies should be utilised exclusively for advocating wage demands. Therefore he was not so much concerned with the rate of wages as with the return given for those wages. (Hear, hear.) Unless they got an adequate return for wages paid, tramways, or any other form of industry, must break down, and people would simply be describing a vicious circle, for there was no greater fallacy than "the less you do the more there is to divide amongst us." He wanted to see the Industrial Councils undertaking their real function of reviving industry, recognising that while there might be points of disputation, it was the duty of all to work for the prosperity of the undertaking, because on that prosperity rested not only dividends but wages and better conditions of life.

Sir Harold Pink, in reply, said that Portsmouth owed much to its tramways, and thanks to the able direction of the chairman and Mr. Spaven, and the staff, the undertaking suffered less during the war than any other town. It was very essential that workmen should act upon the advice of Mr. Roberts. Employers would pay the required wages so long as the men gave full value.

"The Chairman and Members of the Tramways Committee" was submitted by Mr. Goodyer, and reply was made by Mr. Spaven. Mr. Ashdown, a Sheriff of the City of London, in proposing "The Mayor," thanked his worship for the cordial welcome and hospitality extended to the party.

After lunch the party were taken in delightful weather by motor launch up the harbour, and had the opportunity of inspecting the battle cruiser *Audacious*, one of the navy's oil burners. Afterwards there was just time for tea in the Mayor's parlour and a hurried return to the station to catch the 6.50 for Waterloo. The day's programme was in every way successful and interesting, and the members of the party felt much indebted to the Mayor and to Mr. Spaven for their hospitality and the pains which they had taken to make the visit so entertaining and enjoyable.

EYESIGHT OF MOTORMEN.

A committee appointed by the Home Office in December, 1918, issued a report on July 21, 1919, on the subject of disabled men as drivers of public vehicles. They expressed the opinion that no man with only one eye should be allowed to drive a public vehicle, and that for all other men regular standards of ocular efficiency should be introduced. It was recommended that there should be two standards of efficiency of vision.

The Metropolitan Municipal Tramway Managers' Council considered this matter at a meeting on June 25, and expressed the view that the periodical or final examination of eyesight tests should rest with the licensing authority. The London County Council have since concurred in this view, and the recommendations contained in the report of the Committee by the tramways department will be carried into effect at the earliest possible date.

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STANDARDISATION OF OVERHEAD LINE MATERIAL.

REPORT OF THE SUB-COMMITTEE OF THE MUNICIPAL TRAMWAYS ASSOCIATION (INCORPORATED).

We believe that the formation of this sub-committee was due in the first place to a letter, dated April 27, 1917, from Messrs. Brecknell, Munro and Rogers, of Bristol, to the hon. secretary of the association, drawing attention to the enormous number and variety of sections and sizes of trolley wire, and to the multiplicity of fittings which were then manufactured and stocked in order to suit the particular requirements of engineers of tramway undertakings. The firm named suggested that if some standardisation of overhead material could be agreed upon, the delivery of fittings would be more quickly made, and the cost of them would be materially cheapened, inasmuch as manufacturers would not have to stock the large number of patterns necessitated by small orders for separate undertakings. With standard fittings they could stock large quantities and effect delivery at considerably reduced prices.

As a consequence the sub-committee was appointed, consisting of Messrs. W. Boot (Nottingham), H. Dudgeon (Birmingham), L. E. Harvey (Ilford), J. F. Simpson (Preston), S. W. A. Sturman (Sheffield), H. Weston (Salford), and R. H. Wilkinson (Bradford). Subsequently the Tramways and Light Railways Association was asked to appoint representatives, and Messrs. J. B. Tippetts (British Electrical Federation, Limited), W. Nairn (Bristol), C. J. Jewell (Wakefield), and J. F. Bennett (Metropolitan Electric Tramways) were appointed. Mr. Bennett was unable to attend the meetings. Later, Messrs. J. Ferguson (Glasgow) and J. J. McMahon (Manchester) were appointed upon the sub-committee. Mr. L. E. Harvey was appointed chairman, and Mr. S. W. A. Sturman hon. secretary.

Since the sub-committee was appointed 30 meetings have been held—Birkenhead (1), Birmingham (4), Bristol (3), Bradford (1), Preston (2), Leicester (1), Leeds (7), Manchester (1), Nottingham (2), Sheffield (2), Salford (5), West Ham (1).

At an early meeting it was recognised that the first duty of the committee would be to obtain from every tramway undertaking, a complete description of the trolley wire and fittings then in use, so that the members could judge of the scope of their work. Accordingly a detailed questionnaire was sent out to all the municipal undertakings. At a later date, with the co-operation of the secretary of the Tramways and Light Railways Association, the questionnaire was also sent to the company undertakings. The replies thereto were made by almost every undertaking. The answers received disclosed an extraordinary state of affairs, establishing the fact of the widest divergence of practice, and serving to emphasise the necessity for securing some measure of simplification. From the fact that there were upwards of 30 different sizes and sections of trolley wire in use in this country, and that one firm manufactured as many as 50 different sizes of insulated bolts, whilst another had over a thousand different patterns of line ears, the importance of the investigations will be realised. Messrs. Brecknell, Munro and Rogers, Bristol; Messrs. British Insulated and Helsby Cables, Limited, Prescot; and Messrs. Alfred Wiseman, Limited, Birmingham, submitted to the sub-committee a large variety of exhibits of overhead line fittings then in use.

The sub-committee in the first instance confined their attention chiefly to the consideration of the section of trolley wire to be recommended for ultimate standardisation, being of opinion that the size and type of trolley wire was the fundamental basis of their investigations. It was recognised from the first that it was not our duty to lay down any hard and fast rule that a certain size of round wire or grooved wire should be used by any tramway undertaking, but that our object was to suggest that if tramway undertakings would adopt certain standard sizes in trolley wire and a certain shape in grooved wire, they would then reap the advantage of quick delivery and lower costs of fittings and wire. If, on the other hand, any manager or engineer desires to use any type of wire fittings which is not standard, there will be no obstacle in his way except that the manufacturer will charge more for the special patterns and will keep him waiting longer for delivery by reason of not having stocks on hand. It is not suggested in this report that undertakings should scrap their present equipment, but that gradually, as and when renewals take place, a standard construction should be adopted.

We had very little difficulty in deciding on the sizes of round trolley wire, and ultimately the standard wire gauges of 1/0 to 4/0 were adopted. From the answers to the questionnaire, it was obvious to us that these sizes would be generally acceptable. When we dealt with the question of the section of grooved trolley wire to be recommended considerable difficulty was experienced. For the purpose of enabling us to consider adequately the strongest and most suitable section to adopt, a great number of tests was carried out by Mr. Dudgeon (Birmingham) and Mr. Jewell (Wakefield). Messrs. British Insulated and Helsby Cables, Limited (Prescot), Thomas Bolton and Sons (Oakamoor), Frederick Smith and Company (Salford), and Messrs. Craddock and Company (Wakefield) were also consulted upon the matter. With the view to ascertaining the effect of fatigue on trolley wire, vibrating tests have been carried out by Mr. Dudgeon (Birmingham). Although the testing machine was specially designed to eliminate, as far as possible, all sources of error, no satisfactory or conclusive results could be obtained—the fatigue of copper apparently being a very variable factor. It was eventually agreed to adopt a standard section of grooved wire corresponding to standard wire gauge sectional area. At several meetings the wire manufacturers named above sent representatives to consult with us on numerous debatable points, and visits have been made to their works to view the processes of manufacture. The specification was finally submitted to the manufacturers and approved of by them. The specification for trolley wire has been arrived at after careful deliberation, and is printed in the Appendix No. 2.

A specification has been prepared for steel span and guard wires, and is printed in the Appendix No. 3.

A general specification for overhead fittings has been prepared, and is also printed in the Appendix No. 4. It has been decided to recommend porcelain insulators, as well as moulded insulators. We have been in communication with the Institution of Electrical Engineers, which has appointed a panel that is now engaged in considering the question of porcelain insulators, but their inquiry is not yet completed, and we are therefore unable to submit their specification for tramway porcelain insulators.

The designs of the various overhead fittings have been considered at great length, the dimensions standardised, and patterns and samples prepared. Messrs. Dudgeon (Birmingham), Sturman (Sheffield), and Weston (Salford) undertook to prepare the necessary detailed drawings, and the other members of the sub-committee desire to thank these gentlemen for the arduous and valuable work done by them. They have prepared the drawings named in the Appendix No. 1. We propose to exhibit at the meeting all the drawings mentioned in the Appendix, as well as a considerable number of samples of overhead fittings. The question of the publication of the drawings for the use of the various undertakings and manufacturers is one for the association to determine.

We suggest that the association should consider the desirability of appointing a permanent sub-committee to investigate any matters that may from time to time arise in connection with the overhead equipment of tramways.

We have not approached the Engineering Standards Committee in any matter connected with this report, preferring to leave matters of further procedure to your Executive Council.

On behalf of the association we beg to offer our cordial thanks to the general managers of tramways in the towns where we have met for the facilities they have provided for us, and for the information they have so readily supplied for the use of the sub-committee.

L. E. HARVEY, *Chairman.*

W. BOOT.	W. NAIRN.
H. DUDGEON.	J. B. TIPPETTS.
C. J. JEWELL.	J. F. SIMPSON.
J. FERGUSON.	H. WESTON.
J. J. McMAHON.	R. H. WILKINSON.

S. W. A. STURMAN, *hon. secretary of the sub-committee.*

APPENDIX No. 1.
LIST OF DRAWINGS.

Drawing No.	Description.
1.	10 times enlarged section of standard grooved trolley wire, gauges 1/0 to 4/0.
2.	10 times enlarged section of 1/0 standard grooved trolley wire and base of line ear.
3.	10 times enlarged section of 2/0 standard grooved trolley wire and base of line ear.
4.	10 times enlarged section of 3/0 standard grooved trolley wire and base of line ear.
5.	10 times enlarged section of 4/0 standard grooved trolley wire and base of line ear.
5a.	10 times enlarged section of 1/0 standard grooved trolley wire and base of splicing ear and section insulator.
5b.	10 times enlarged section of 2/0 standard grooved trolley wire and base of splicing ear and section insulator.
5c.	10 times enlarged section of 3/0 standard grooved trolley wire and base of splicing ear and section insulator.
5d.	10 times enlarged section of 4/0 standard grooved trolley wire and base of splicing ear and section insulator.
6.	6 in. mechanical line ear for 1/0 to 4/0 grooved trolley wire.
7.	12 in. mechanical line ear for 1/0 to 4/0 grooved trolley wire.

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8. 18 in. mechanical line ear for 1/0 to 4/0 grooved trolley wire.
9. 24 in. mechanical line ear for 1/0 to 4/0 grooved trolley wire.
10. Anchor ear for 1/0 to 4/0 grooved trolley wire.
11. 12 in. mechanical feeder ear for 1/0 to 4/0 grooved trolley wire.
12. 18 in. splicing ear for 1/0 to 4/0 grooved trolley wire.
13. 24 in. splicing ear for 1/0 to 4/0 grooved trolley wire.
14. 30 in. splicing ear for 1/0 to 4/0 grooved trolley wire.
15. 36 in. splicing ear for 1/0 to 4/0 grooved trolley wire.
16. Section insulator (centre suspension) for 1/0 to 4/0 grooved trolley wire.
17. Section insulator (end suspension) for 1/0 to 4/0 grooved trolley wire.
18. Top suspension attachment for section insulators.
19. Left-hand poker frog.
20. Right-hand poker frog.
20a. Details of left-hand and right-hand poker frogs.
21. Left-hand mechanical switch frog } For shunting, trolley reversers,
22. Right-hand mechanical switch frog } hand and automatic pulls.
23. Left-hand trailing frog.
24. Right-hand trailing frog.
25. Porcelain insulators.
26. 12 in. mechanical line ear for round trolley wire, 1/0 to 4/0.
27. 18 in. mechanical line ear for round trolley wire, 1/0 to 4/0.
28. 24 in. mechanical line ear for round trolley wire, 1/0 to 4/0.
29. 12 in. mechanical feeder for round trolley wire, 1/0 to 4/0.
30. 18 in., 24 in., 30 in., and 36 in. splicing ears for round trolley wire, 1/0 to 4/0.
31. Section insulator (centre suspension) for round trolley wire, 1/0 to 4/0.
32. Section insulator (end suspension) for round trolley wire, 1/0 to 4/0.
33. 12 in. clinch feeder ear for round trolley wire, 1/0 to 4/0.
34. 12 in. clinch line ear for round trolley wire, 1/0 to 4/0.
35. 18 in. clinch line ear for round trolley wire, 1/0 to 4/0.
36. 24 in. clinch line ear for round trolley wire, 1/0 to 4/0.
37. 36 in. clinch line ear for round trolley wire, 1/0 to 4/0.
38. Dimensions of standard trolley wheel groove.
39. Anchor ear for round trolley wire, 1/0 to 4/0.
40. Double pull off (for use with insulated bolts).
41. Single pull off (for use with insulated bolts).
42. Straight line hanger (for use with insulated bolts).
43. Insulated bolt.
44. Bridge hanger.
45. Trolley wire terminal clamp.
46. Turnbuckle.
47. Clevis and porcelain reel insulator for bowstring suspension.
48. Flexible span bracket arm fittings.
49. 25 deg. crossings, for 1/0 to 4/0 trolley wire.
50. 45 deg. crossings, for 1/0 to 4/0 trolley wire.
51. 90 deg. crossings, for 1/0 to 4/0 trolley wire.
52. Straight line hanger, double pull-off and single pull-off. With porcelain insulation.
53. Double and single pull-offs, uninsulated type.
54. Emergency splicing ear.
55. Pole strap, bull rings, eye bolt, hook bolt, and connecting links.
56. Giant strain insulators.
57. Span carrier for section insulator where end suspension is used.
58. Diagonal anchor plate.
59. Pole crank lever and spindle for switch frog pull.
60. Pole strap with porcelain reel insulator.

Appendix No. 2.

Suggested Specification for Standard Copper Trolley Wire.

(1) *Material.*—The wire shall consist of hard-drawn electrolytic copper.

(2) *Size of Wire.*—The wire shall be truly and fully up to the section specified. It shall be perfectly symmetrical, and no variation from the approved cross section greater than 1 per cent. plus or minus on any dimension will be permitted.

(3) *Finish.*—The wire shall be drawn direct from the solid rod made from billets of not less than 250 pounds in weight.

The joints shall be made in the soft rod with hard silver, and shall afterwards be drawn three times through a die to the finished size. The wire at a joint shall conform to the same tests and electrical conductivity as is hereafter specified for its particular section.

The wire must be free from kinks and inequalities, and it shall not contain any scale, flaws, cold shuts, seams, or other defects.

(4) *Tests.*—The tests which are described in the following paragraphs shall be made in the presence of the purchasers' engineer, the necessary apparatus for making such test being furnished by the contractor. The purchasers, however, shall have the right of furnishing any part of the apparatus as they may think fit.

The apparatus furnished by the contractor shall be examined and approved by the purchasers' engineer. Failing agreement on this point the test shall be taken by a recognised standard testing institution.

The tensile strength, elongation, and torsion tests specified shall be determined by taking samples from each reel 36 in. in length. Should the first sample selected fail to come up to the specification, the engineer shall take two more samples at his discretion. If the results from the second and third tests shall be within the specification, the reel shall be accepted. If they shall not be within the specification, the reel may be rejected. A certificate shall be supplied by the contractor to the purchaser showing actual test results made on each reel of wire supplied.

The following tests shall be made—

(5) *Tensile Strength and Elongation.*—A sample length shall be tested for tension and elongation by breaking the same in a testing machine. The elongation shall be measured by marking the wire in two places, 10 in. apart, which shall coincide with the distance between the jaws of the machine. The fracture must take place between these marks and at a point not less than one inch away from either mark.

The samples shall show a minimum tensile strength in accordance with the following table—

Gauge Number S.W.G.	Area of Cross Section. Sq. Inches.	Circular Wire.	Grooved Wire.
1/0	·08245	24·5 tons per sq. in.	23·5 tons per sq. in.
2/0	·09511	24·0 ,, ,,	23·0 ,, ,,
3/0	·10869	24·0 ,, ,,	23·0 ,, ,,
4/0	·12566	23·5 ,, ,,	22·5 ,, ,,

The elongation on fracture for all forms of wire shall be not less than the following—

No. 1/0 S.W.G. 2 per cent. in the 10 in. length.
No. 2/0 S.W.G. 2½ ,, ,, 10 ,,
No. 3/0 S.W.G. 3 ,, ,, 10 ,,
No. 4/0 S.W.G. 3 ,, ,, 10 ,,

(6) *Torsion Test.*—For the purpose of developing and exposing defects in trolley wire the following tests shall be made—

A sample of the wire shall be placed between the holders of the machine and shall be twisted to destruction. The length tested shall be 10 in. between the grips. If any seams, pits, slivers, or surface imperfections shall be revealed the wire may be rejected. The samples shall withstand the following number of turns without breaking—

Gauge No.	Circular Wire.	Grooved Wire.
1/0	11 twists	10 twists
2/0	10 twists	9 twists
3/0	9 twists	8 twists
4/0	8 twists	7 twists

The rate of twisting shall not be more than 10 turns per minute.

(7) *Weight.*—The weight of the wire per mile shall be as follows—

Area of Cross Section Equivalent to	Weight per Mile.
No. 1/0 S.W.G.	1,678 lb. per mile
No. 2/0 S.W.G.	1,935 ,,
No. 3/0 S.W.G.	2,212 ,,
No. 4/0 S.W.G.	2,558 ,,

A variation of 2 per cent. on either side of these figures will be permitted.

(8) *Electrical Resistance.*—The resistance of the finished wire shall not exceed the following—

Standard Wire Gauge.	Resistance in Ohms per 1,000 yds. at 15·5° C. (equals 60° F.).
No. 1/0	·2969
No. 2/0	·2574
No. 3/0	·2253
No. 4/0	·1948

(9) *Packing for Shipment.*—The wire shall be put on reels of approved design and of sufficient size to prevent sharp bends, and shall be properly protected, so that it shall not be injured in transportation. The committee suggest that the dimensions of the reels shall be as follows—

24 inches diameter of barrel.
24 inches wide between the inside of flanges.
36 inches diameter over flanges.
2 in. clear square hole through centre.

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Care shall be exercised in winding grooved sections of wire on to the drums to ensure complete absence from twist when being unrolled.

Each reel shall have its gross, net, and tare weights, together with the length and size of wire, plainly and indelibly marked on the outside of the reel.

(10) *Grooved Trolley Wire.*—It is recommended that the grooved wire adopted shall be as shown on the drawing No. 1.

APPENDIX No. 3.

SUGGESTED SPECIFICATION FOR STEEL SPAN AND GUARD WIRES.

The wire shall be of mild steel uniformly annealed, pliable, free from all flaws and other defects, and galvanised with zinc and spelter before being stranded together.

The steel shall have a tensile strength of 28/35 tons per square inch, with an elastic limit of not less than 35 per cent. of the breaking stress.

The breaking stresses of the various wire shall be as follows—

Gauge.	Minimum.	Maximum.
No. 8 S.W.G.	1,261 lb. ...	1,576 lb.
No. 7/12 ,, ...	3,500 lb. ...	4,375 lb.
No. 7/14 ,, ...	2,100 lb. ...	2,625 lb.
No. 7/16 ,, ...	1,400 lb. ...	1,750 lb.

Samples taken from the coils and plunged into a saturated solution of sulphate of copper at 60 deg. F. for one minute, then dipped and wiped a further three times, must not show any sign of a reddish deposit of metallic copper on the wire.

The wire, both stranded and single (with the exception of the No. 8 gauge) must stand being bent round a horse-collar thimble, measuring 1 in. external diameter over the largest breadth, and after being so bent must pass the last-named dipping test.

No. 8 S.W.G. single wire shall stand the last test after being bent round a 2 in. thimble.

The size of the coils shall be to the satisfaction of the purchasers' engineer.

APPENDIX No. 4.

SUGGESTED SPECIFICATION FOR OVERHEAD WIRE FITTINGS.

Metal.—The gun-metal shall be of the following mixture—

Copper	88 per cent.
Tin	10 per cent.
Zinc	2 per cent.

A test piece of the metal having a sectional area of 1 sq. in. shall be capable of withstanding a tensile stress of not less than 15 tons, with an elongation on fracture of between 15 per cent. and 20 per cent. measured on an 8 in. length.

The malleable iron shall be made from the best quality malleable pig-iron, and be well and properly annealed. A standard test piece of form "B" 2 in. wide by $\frac{3}{8}$ in. thick, called for by the Engineering Standards Committee, shall stand being bent through an angle of 90 degrees over a radius of one inch without sign of fracture. It shall have an ultimate tensile strength of not less than 17 tons per sq. in., with an elongation of 4 per cent. in a length of two inches.

Where galvanising is called for, the casting shall be well cleaned and the hot process applied, best quality spelter being used. All threads are to be hot brushed.

The steel must be dropped-forged and of the best quality. A standard test piece of the form of "C" of $\frac{1}{4}$ sq. in. area by 2 in. gauge line, called for by the Engineering Standards Committee, machined cold lengthwise from each of the forgings selected must, without heating or any other manipulation whatever, show a tensile breaking strength of not less than 25 tons or more than 32 tons per sq. in., with an elongation of not less than 27 per cent. or more than 20 per cent. in 2 in. respectively.

Composite Insulated Fittings.—These are to be thoroughly waterproof and homogeneous. Five per cent. of the quantity ordered shall be tested by being soaked in water at a temperature not exceeding 80 deg. F. for a period of 24 hours, and then taken out and wiped dry, after which the fittings shall be capable of withstanding 2,500 volts, alternating current, for five minutes applied between the metal parts, which are insulated from each other. Before delivery each fitting shall be subjected to a flash test of 2,500 volts alternating current.

Threads.—All threads shall be of Whitworth's standard, full and clean out, and shall be a good running fit.

The following fittings shall be of the design and sizes recommended on the drawings—

Ears.—The grooves shall be of the approved profile and of smooth finish, tinned if required, so as properly to fit the wire to be supported.

Double Pull-offs.—These shall be of the metal specified, capable of withstanding a straight pull of 1,500 lb. at the bottom of the arms, without being distorted in the body so as to prevent the bolt being put in. They shall withstand a tensile stress of 4,000 lb. without showing signs of fracture. The hole before testing must not be more than 1-32 in. larger in diameter than the size of the insulated bolt used.

Single Pull-offs.—These shall be capable of withstanding the same stresses as those specified for double pull-offs, but the test shall be applied between the end of the bolt and the arm.

Straight Line Hangers.—These shall be capable of withstanding a stress of 3,500 lb. on the span wire without showing any signs of distortion or fracture.

Locking Cap for Pull-offs and Hangers.—This shall be a proper fit and interchangeable, and arranged so that it can be used repeatedly without being destroyed. A leather washer at least $\frac{1}{8}$ in. thick shall be inserted in the cap.

Globe Insulators.—These must be capable of withstanding a tensile stress of 5,000 lb. without fracturing when heated to a temperature of 100 deg. Fahr.

Insulator Bolts.—These are to be made in one piece of drop-forged steel of smooth finish, evenly finished so that the bolt is truly central with the insulation.

Porcelain Insulators.—Where porcelain is called for, it shall be made of carefully selected materials combined in proportions to give the best electrical and mechanical strength, and the final product must be dense, impervious to moisture, and be thoroughly vitrified. It must not depend upon the glaze for its insulating qualities. Each insulator shall withstand a pressure of 5,000 volts alternating current, between adjacent metal parts.

L.C.C. TRAMWAYS ACCOUNTS.

At the meeting of the London County Council on July 6 the Highways Committee submitted the accounts for the year ended March 31, 1920, together with a memorandum by the general manager on the working of the undertaking. The report states that the tramways have a total street length of 149·1, of which 144·5 are electric lines(121·93 conduit, and 22·57 overhead) and 4·6 miles of horse lines. The income and working expenses were as follows—

	£ s. d.	£ s. d.
Income		4,295,846 3 4
Working expenses		3,680,909 2 6
Surplus on working		614,937 0 10
Deduct—Charges against surplus on working—		
Interest (£248,491 0s. 6d.), Redemption — instalment method (£426,833 2s. 9d.) ...	675,324 3 3	
Income Tax	117,646 6 0	
Other charges	4,565 5 3	
	797,535 14 6	
Less—Tax deducted and retained from interest on debt (£73,579 14s. 8d.) and recoverable debt charges (£8,296 14s. 6d.) ...	81,876 9 2	
		715,659 5 4
Deficiency for year		£100,722 4 6

The deficiency has been met partly from the balances of the renewals fund and the general reserve fund, leaving a net deficiency of £18,824, which is carried forward. The capital expenditure on the undertaking up to March 31, 1920, amounted to £13,887,632, of which £193,880 represents expenditure during the year 1919-20, including £142,687 for half cost of renewals of track. The amount of the debt incurred up to March 31, 1920, was £14,216,715. The net debt outstanding on March 31, 1920, after allowing for debt repaid out of revenue and sinking fund balances, and for £120,216 in respect of the value of surplus land, was £8,068,569. The total number of passengers carried was 685,124,156, and the car-miles run were 53,156,060.

ESTIMATED POSSIBLE LOSS OF OVER £1,000,000.

The estimates for the year 1920-21 show a total deficiency, including the debt charges, etc., of £749,442. Assuming that the Treasury agreed to certain proposals of the Council as to the debt, but not as to the renewals, the estimated loss would be £929,512. If consent were not obtained to either of the proposals, the total deficiency would reach £1,038,512, or the equivalent of a special county rate of over 6½d. in the £ in the current financial year.

Regulation of Chars-a-bancs.—The Highways Committee of the Southend Town Council has resolved to suggest to the Watch Committee the desirability of selecting the thoroughfares through which large motor chars-a-bancs visiting the town may be permitted to proceed.

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EDINBURGH CORPORATION OMNIBUSES.

PROBABLE EXTENSION OF OMNIBUS SERVICES. RESULTS OF FOUR-AND-A-HALF MONTHS' WORKING. SUCCESS OF MOTOR COACHES FOR TOURISTS' DRIVES.

The references to the motor omnibus service in the recently issued report of the general manager of the Edinburgh Corporation tramways, Mr. R. S. Pilcher, indicate that the Tramways Committee have an open mind on the question of motor omnibuses as an adjunct to the tramway service. The first omnibus service of the Corporation was begun on December 29, 1919, the vehicles running between Ardmillan Terrace and Easter Road. The detailed figures for the working of this route, which cover a period of four-and-a-half months, are given below, and it will be seen that the net result is a profit of £1,482 19s. 2d. This has been earned on a new route previously not provided with any transit facilities. As Mr. Pilcher remarks, it cannot be expected that the same percentage of profit would be obtained on other routes, or indeed on the same route in the future, because as additional vehicles are delivered the service will be increased, and the earning capacity per omnibus-mile will consequently diminish. When the omnibuses have been in service for a longer period the cost of repairs and maintenance will, of course, increase. On the other hand, it must be noted that depreciation has been charged on this year's working on a five years' basis, and next year depreciation on the omnibuses will be allowed at the rate of eight years. Experience already obtained with the new route shows quite clearly that the omnibus can be run on a remunerative basis even under present conditions, and that there is scope for its development in Edinburgh.

Mr. Pilcher points out, in contrasting electric tramcars with omnibuses, that the former have the greater carrying power and that they are more helpful in dealing with heavy traffic of the rush hours. For main lines of traffic he thinks the future of the tramcar is assured, while for suburban routes, where traffic is not fully developed the omnibus will be used. He suggests that arrangements in the direction of electrification should be made without delay, and says that the Electricity Department will be in a position to give a sufficient supply of current to operate the first section electrically in the spring of 1922. With regard to connection with Leith, Mr. Pilcher says the "Pilrig Muddle" causes 7,000,000 passengers a year to change from one vehicle to another. There ought to be through-running facilities, he declares. The tramways in Leith, Mr. Pilcher recognises, are efficient and in good condition, the traffic is heavy and the cars, which have a larger seating capacity than omnibuses, can be run cheaper per car-mile. In these circumstances there should not arise the question of discontinuing the tramways or permitting an omnibus service to compete with or in any way injure the system. Mr. Pilcher estimates the cable system assets, convertible to electric traction, at £804,000. These assets would be thrown away if motor omnibuses were to be adopted.

The motor coaches which were introduced last summer for tourist drives have been a considerable success. The number of vehicles has been increased and they have been much appreciated, as they provide a convenient means to the visitor of seeing the beautiful suburbs of the city. During the period of four-and-a-half months 39,806 tourists were carried by the coaches, the distance run was 14,743·5 miles and the receipts £1,922 19s. 6d., or 31·30d. per vehicle mile.

ACCOUNTS OF EDINBURGH CORPORATION'S MOTOR OMNIBUS SERVICES FOR FOUR-AND-A-HALF MONTHS.

Expenditure.	July 1, 1919, to May 15, 1920.	Per 'Bus Mile.
	£ s. d.	d.
Traffic expenses—		
Superintendence	5 2 5	·016
Wages of drivers and conductors	2,067 5 9	6·437
Wages of inspectors	19 16 6	·062
Wages of other traffic employees	12 6 9	·038
Ticket check	90 18 2	·282
Uniforms	69 7 11	·218
Licences	90 11 0	·282
Cleaning, oiling, and lighting	643 9 4	2·003
Miscellaneous	88 18 5	·277
	3,087 16 3	9·615
General expenses—		
Salaries of staff	59 3 2	·184
Store expenses	25 18 9	·081
Office expenses	12 8 8	·039
Printing and stationery	21 18 2	·068
Fire insurance	36 9 8	·113
Accident insurance	153 19 2	·479
Employers' Liability Insurance	36 10 9	·114
National Health Insurance	10 12 4	·033
Rent of garage	153 2 6	·477
Rates	31 19 1	·100
Income tax	—	—
Miscellaneous	16 8 5	·051
General expenses of management—Proportion	45 10 0	·142
	604 0 8	1·881
Repairs and maintenance—		
Chassis	399 16 11	1·245
Bodies	256 11 8	·800
Tires	93 16 4	·291
Plant, etc.	45 13 0	·142
	795 17 11	2·478
Power expenses—		
Petrol	2,069 0 7	6·442
Total working expenses	6,556 15 5	20·416
Balance carried forward to net revenue account, No. II.	2,353 15 5½	7·329
	£8,910 10 10½	27·745

Income.	July 1, 1919, to May 15, 1920.	Per 'Bus Mile.
	£ s. d.	d.
Passenger fares—		
Motor chars-a-bancs / Motor omnibuses	8,772 7 0½	27·315
Miscellaneous—		
Special hires	25 7 0	·079
Work done by chars-a-bancs as lorries for tramways	112 16 10	·351
Total	£8,910 10 10½	27·745

NET REVENUE ACCOUNT.

Income.	July 1, 1919, to May 15, 1920.
	£ s. d.
Balance brought from Revenue Account No. I	2,353 15 5½
Interest from Corporation Loan Fund on Credit Balances for ordinary expenditure	14 6 4
	£2,368 1 9½

Expenditure.	July 1, 1919, to May 15, 1920.	Per 'Bus Mile.
	£ s. d.	d.
Interest on Loans for Capital Expenditure	85 2 7	2·756
Sinking Fund contribution	800 0 0	4·618
Profit as at May 15, 1920	1,482 19 2½	—
	£2,368 1 9½	—

Organisation of Haulage Facilities.—Under the auspices of the Liverpool and District Motor Haulage Contractors' Association there has been formed the North-Western Consolidated Transports, Limited, with offices at Liverpool and Manchester. As necessity requires, agencies will be established in other districts. The object of the new organisation will be, by bringing into co-operation the owners of motor vehicles, to provide a reliable and prompt service, including supervision of the loading and running. There will be pooling of the resources of the various haulage firms, and placing the same under the direction of a traffic manager.

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LEEDS CORPORATION TRAMWAYS.

In his annual report for the year ended March 31, 1920, Mr. J. B. Hamilton, the general manager, states that the receipts amounted to £876,526, an increase of £153,492, or 21·23 per cent., over those of the previous year. The earnings per car-mile were 21·286d., as compared with 18·954d. This increase is partly attributable to the advance in fares which took effect on June 10, 1918, but the main cause is the greater number of passengers carried during the year. Owing to the improvement in the supply of material it was found possible to place twenty more cars in service during the year, and the number of passengers carried exceeded those of the previous year by 16,314,061, or 13 per cent. Mr. Hamilton points out, however, that the increase in receipts should be considered in conjunction with the constantly advancing working expenses. These amounted to £606,347, an increase of £184,937, and the increase in working expenses exceeded the increase in revenue by £31,445. The average expenses per car-mile works out at 14·725d., as against 11·047d. in the previous year, while the percentage of working expenses rose from 58·28 per cent. to 69·17 per cent. The principal cause of the large increase in expenses was, of course, the advance in wages. Taking into account the additional number of employees engaged during the year, the wages bill aggregated to a sum of £406,285, an increase of £133,187, or 48·7 per cent. The expenditure on general repairs and maintenance showed an increase of £58,733. Permanent way repairs have cost £28,199 more than in the previous year. The extra cost under the heading of cars amounted to £22,708. The staff and employees in all departments numbered 2,598.

Year ended March 31	1920.	1919.	1918.	1917.	1913.
INCOME—					
Traffic revenue	£867,256	£712,522	£577,168	£507,755	£407,551
Advertising	2,894	2,721	2,941	2,943	3,662
Mineral haulage	2,033	3,010	1,794	1,397	—
Rents	3,120	4,626	4,728	3,711	95
Loan of tramcars	1,097	—	—	—	—
Miscellaneous	126	154	—	—	223
	£876,526	£723,033	£586,631	£515,806	£411,531
EXPENDITURE—					
Traffic	£299,889	£209,044	£158,282	£122,499	£109,413
General	66,698	51,986	43,942	39,832	36,055
Repairs and maintenance ...	171,864	113,131	73,607	53,291	39,894
Power expenses	63,844	45,521	38,212	23,027	24,700
Energy purchased	—	—	—	12,070	3,755
War bonus to employees ...	—	—	—	10,766	—
Parcels traffic	4,052	1,727	—	—	—
	£606,347	£421,409	£314,043	£261,485	£213,817
Balance	£270,179	£301,624	£272,588	£254,320	£197,713
Interest	4,553	2,835	3,435	2,379	2,283
Dividends on investments ...	24,952	17,870	12,864	7,377	5,228
	£299,684	£322,329	£288,887	£264,076	£205,224
Interest on property	£3,953	£3,953	£3,953	£3,343	—
Interest on capital	55,220	55,749	53,473	49,777	42,197
Income-tax	44,431	35,844	23,257	17,847	5,020
Rent of lines	2,642	2,800	2,964	3,018	3,217
War allowances	1,393	10,479	12,053	12,890	—
Balance	192,045	213,504	193,187	177,201	154,790
APPROPRIATED AS FOLLOWS—					
Redemption fund	£70,692	£68,828	£66,881	£64,205	£49,923
Cost of Acts	445	445	445	445	403
Renewals	36,350	54,231	61,766	30,000	41,752
Contribution to capital outlay	800	—	2,742	2,373	1,337
Third party risk reserve ...	—	—	—	747	—
Reserve fund	—	—	3,353	—	—
Net surplus	83,758	90,000	58,000	79,431	61,375

PERNAMBUCO TRAMWAYS AND POWER.

The eighth ordinary general meeting of the Pernambuco Tramways and Power Company, Limited, was held in July at River Plate House, Mr. William Higgins, O.B.E., presiding.

The Secretary (Mr. H. Tattam) read the notice and the report of the auditors.

The Chairman first apologised for the absence of Mr. Follett Holt, remarking that that gentleman was on a visit to South America and intended before his return to visit Pernambuco and make a thorough inspection of the company's properties. From the accounts presented shareholders would notice a perceptible increase in receipts, although they would realise that this owed something to the higher rate of exchange ruling throughout the year. The working expenses had also increased, but the net result of the year's working was an increase in net revenue of approximately £21,500. The directors were placing £23,000 to renewal and general reserve account, and after providing for amortisation they recommended a dividend of 3½ per cent., free of tax, on the preference shares, carrying forward £16,909. In the circumstances he thought this position must be deemed satisfactory. Working expenses, of course, continued to be seriously affected by the extraordinary prices ruling for practically every item required in maintaining and running such an undertaking. He would not attempt to prophesy what was going to happen in the near future, but personally he took a certain amount of comfort in hoping they had reached the peak as regarded prices, and that if there should be any material change in the immediate future it would be favourable rather than otherwise.

The directors were applying to the Government of the State of Pernambuco for power to raise the company's rates. The rates fixed when the company obtained their concession in 1912 were, due to circumstances absolutely beyond their control, totally inadequate to-day. Whereas in 1914 their coal delivered in Pernambuco cost them £1 13s. per ton, to-day it was costing them at least £8. There was nothing they used that had not gone up at least 100 per cent., and many things had increased as much as 300 per cent. Then, again, Pernambuco, like every other part of the world, had felt the pinch with regard to the increased cost of living, and this had resulted in their having to give their employees an appreciable increase in wages. It was, therefore, reasonable to hope that the Government of the State, having regard to the world-wide upheaval we had just had, and were still passing through, would deal with the question of rates in a sympathetic manner. The directors believed in the justice of their appeal to the Government, who, they trusted, would appreciate the reasonableness of the request and agree to assist the company.

With regard to the company's business generally, their tramway section continued to show development. They had carried an increased number of passengers, and the increase would have been still greater had it not been for the extreme difficulty they had in obtaining materials for renewal, owing to which they had sometimes had cars out of service for considerable periods. With regard to electric lighting and power, the directors still believed in the great possibility of this branch of their business, and were doing all they could to meet the demand that undoubtedly existed in Pernambuco. A year ago the directors reported that the first section of their lighting and power programme had been inaugurated, and he was glad to say that the expenditure incurred had proved, and continued to prove, remunerative. In fact, they were not able to cope with the requests for supply which they received from the public. Their gas undertaking had resulted in a loss for the year under review, but this was entirely due to the fact that they had had to pay extraordinarily high rates for coal, often of very inferior quality. The Telephone Company of Pernambuco, the bulk of the shares in which were held by this company, continued to show an increased number of subscribers.

The report was unanimously adopted.

FINANCIAL REPORTS AND MEETINGS.

UNDERGROUND ELECTRIC RAILWAYS COMPANY.—The directors announce that profits for the half-year ended June 30, after paying the full interest on the 6 per cent. first cumulative income debenture stock, amount to £42. This does not allow of any payment on the 6 per cent. income bonds, and the £42, together with the amount of £22,938 brought forward, has been carried to the special reserve for equalisation of interest.

LONDON ELECTRIC RAILWAY.—Dividend on the ordinary shares of ½ per cent. (comparing with 1 per cent. for the same period of 1919).

CITY AND SOUTH LONDON RAILWAY.—Dividend on the consolidated ordinary stock of ½ per cent. (comparing with 1 per cent. for the same period of 1919).

METROPOLITAN DISTRICT RAILWAY.—Dividend on the 5 per cent. second preference stock of 1½ per cent. (comparing with 2½ per cent. for the same period of 1919).

LONDON GENERAL OMNIBUS.—The directors state that the financial position of the company does not justify them in declaring an interim dividend on the shares of the company. A year ago 4 per cent. was paid.

CENTRAL LONDON RAILWAY.—Dividends on the undivided ordinary stock of ½ per cent., and on the preferred ordinary stock of ½ per cent. (comparing with 2 per cent. for the same period of 1919).

DUBLIN UNITED TRAMWAYS COMPANY.—The directors have declared an interim dividend for the half-year to June 30 at the rate of 4 per cent. per annum on the ordinary shares.

INCREASING COSTS OF THE LONDON UNDERGROUND GROUP.—The Underground group of companies estimate that the wages bill for the current year will exceed £6,000,000, an increase of £4,000,000. In 1913 the amount paid in wages was £2,000,000. Petrol, which in 1913 cost the companies £400,000, will this year cost at least £1,400,000.

LIVERPOOL OVERHEAD RAILWAY COMPANY.—The interim dividend for the half-year ended June 30 is at the rate of 5 per cent. per

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annum on the preference shares, and 2½ per cent. per annum on the ordinary shares.

COLOMBO ELECTRIC TRACTION AND LIGHTING COMPANY.—The profit for 1919 amounted to £48,324. A dividend of 10 per cent., free of income-tax, is announced, after placing £20,000 to general reserve and renewals fund. The balance forward is £15,240.

BARNSLEY DISTRICT TRACTION COMPANY.—After setting aside £7,100 to renewals fund, there is, including £686 brought forward, available the sum of £15,640. The dividend of 12 per cent. is recommended, carrying £10,324 forward, subject to excess profits duty.

GLASGOW TRAMWAY RECORDS.—Glasgow Corporation Tramways have made another record for the week ended July 3, when the receipts amounted to £44,964, as compared with £44,957 in the preceding week. A new record was created for Sunday, June 27, when £5,170 was taken, as compared with £3,876 on the same date a year ago.

EDINBURGH TRAMWAYS DEFICIENCY.—At a meeting of the Edinburgh Tramways Committee on July 7, the city chamberlain reported a deficiency on the tramways accounts for the period from June 1919, when the Corporation began to work the undertaking, to May 15, 1920, of £21,789. The deficiency is being carried to the current year's account.

ROCHDALE CORPORATION TRAMWAYS.—There is a loss on the year's working of £2,682, compared with a profit of £662 last year. The receipts amounted to £161,457, and the working expenses to £94,603. The balance from revenue amounts to £66,853, and the interest on capital, sinking fund charges, war bonus, rents and other charges amount to £71,349.

BRITISH AUTOMOBILE TRACTION COMPANY.—The past year's trading of this company resulted in a net profit of £31,304, and a dividend at the rate of 10 per cent. is recommended on the ordinary shares, with £4,852 to reserve, and £13,517 carried forward. The capital is now £300,000, of which £150,000 has been created in ordinary shares since the close of the past year.

MANCHESTER CORPORATION TRAMWAYS.—The revenue amounted to £1,586,863, and working expenses to £1,207,230, leaving, plus bank interest, £398,494. After meeting interest on capital, redemption of debt, rent, and other charges there was a surplus of £170,657, of which £111,891 has been devoted in aid of the rates, £80,229 to the renewals fund, and £35,716 to income-tax. The contribution to the rates is the same as last year. Since 1902 the relief to the rates from the tramways has been £1,438,872.

BURNLEY CORPORATION TRAMWAYS.—While the income increased by £34,388, the expenditure went up by £42,012. Wages and cost of material have increased by £30,000. The advanced cost of energy, after deducting 15 per cent. for increased mileage, amounted to £3,237. The revenue from the undertaking amounted to £158,601 and the expenditure £137,951, leaving a balance of £20,649 carried to the net revenue account. The rent and other charges exceeded this amount by £2,095, which was transferred from the reserve fund.

SUNDERLAND CORPORATION TRAMWAYS.—The report for the past financial year shows that the receipts amounted to £149,126, and the total passengers carried to 31,500,000. The traffic expenses amounted to £55,000, of which £38,316 was for wages. The renewals, reserve, and compensation funds now aggregate £63,898. In 1901, the first year of operation, the receipts amounted to only £24,900 and 5,000,000 passengers were carried. Since the opening of the undertaking the sum of £77,027 has been given to the relief of the rates.

BLACKBURN CORPORATION TRAMWAYS.—A balance of £17,438 is shown, the receipts, £121,550, being an increase from £94,992 the previous year. Last year's balance was £25,971. After meeting sinking fund charges, loans, etc., the profit amounted to £413, compared with £6,650 in the previous year. The cost of running per car-mile increased from 2·75d. to 3·41d. The chief increases in expenditure are as follows, the amount of the preceding year being given in parentheses—Wages of motormen and conductors, £26,887 (£18,289); permanent way repairs, £12,500 (£5,406); electrical current, £17,772 (£12,286); electrical equipment of line, £3,984 (£1,835); cars, £8,378 (£5,910).

WOLVERHAMPTON CORPORATION TRAMWAYS.—The profit for the year amounted to £22,204, which includes £376 in the chars-a-bancs account. The amount was absorbed by interest on capital, income-tax, repayment of loans, additions and improvements (£928), and the reserve and renewal fund (£5,838). This fund is now £63,572, and there is also £16,130 to the credit of the maintenance and repairs suspense account. The wages bill increased by £21,466 to £57,019. Compared with 1914 the cost of electricity has increased by 100 per cent. Traffic receipts increased from £88,787 to £101,982. The balance on net revenue account carried to appropriation account is £13,330, on which a balance was brought forward from last year of £17,915. From the total £10,000 has been voted in aid of the rates, compared with £6,580 for the previous year.

BRIGHTON CORPORATION TRAMWAYS.—Revenue £116,838, compared with £64,819 four years ago. Working expenses increased in the same period from £41,498 to £98,158. After meeting capital charges the accounts show a balance of £1,981, but if permanent way renewals are included, the costs of which are debited to the renewals fund, the expenditure exceeded the revenue by £8,144. Referring to the effect of the increased fares, the report states that the average fare received for each of the ten years up to March, 1919, had been about 1·1d. per passenger, but during last year it rose to 1·35d., an average increase of exactly a farthing. Calculated on the number of passengers carried this amounts to £20,240, leaving £9,101 as due to extra passengers. The following analysis of the wages bill is partly estimated, but the figures are as nearly correct as circumstances allow—Wages at present basic rates, £24,000; war bonus, £24,370; wages and war bonus of additional men employed on account of reduced working hours, £11,340; total, £59,710. The total wage bill in 1916 was £17,739.

LEEDS CITY TRAMWAYS.—In accordance with the instructions of the Leeds Tramways Committee, the general manager (Mr. J. B. Hamilton) has issued a statement showing the total revenue and total costs of operation covering the period from June 3 to June 30, 1920. The traffic and sundry revenue amounted to £80,517, and the expenditure to £86,947, leaving a deficit of £6,430 (average per day £229). There was an increase of 1 per cent. in the number of passengers. For the corresponding period a year ago the receipts were £75,238, the increase for the present year being £5,279. The results of operation from April 1 to June 30, 1920, are as follows—

Per car-Mile.			Corresponding period, 1919.
22·708d.	Traffic and sundry revenue	£241,662	£229,897
24·842d.	Expenditure	264,369	——
2·134d.	Deficit.	22,707 (Av. per day £249.)	

BIRMINGHAM DISTRICT POWER AND TRACTION COMPANY.—The report for the year ended December 30, 1919, shows that the net revenue from tramways and investments amounted to £95,812. Deducting general expenses, payments to local authorities, and other charges, and including £6,030 brought in, there is a surplus of £73,954. A dividend of 6 per cent. for the year is recommended, carrying forward £4,354. Powers to raise fares are to be sought under the Tramways (Increase of Fares) Act, as owing to increases in wages and other charges the present rates are inadequate. Mr. C. S. B. Hilton, who presided at the annual meeting on July 13, said that after providing for the dividend on preference shares, placing £10,000 to renewals, and making a small allocation to reserve, they were able to recommend a dividend of 6 per cent. on the ordinary shares and to carry forward £4,354. They were still faced with the constantly increasing demands for higher wages and the ever increasing cost of material. Every possible economy had been exercised, consistent with efficient management, and fares had been increased so far as practicable under the present Act and Orders. It was doubtful if the results would justify further increases, as signs were not wanting that the economic limit had been reached. There were indications that trade in the district was beginning to fall, and if that once took place their receipts would be affected. Tramway receipts were a very good barometer of the condition of trade.

PERSONAL.

Mr. C. H. Wordingham has been appointed consulting electrical engineer to Aylesbury Town Council.

Mr. J. T. C. Salmon has resigned the chairmanship of the Yarmouth Tramways Committee on the ground of ill-health.

Mr. R. S. Pilcher, general manager of the Edinburgh Corporation Tramways, has been granted an increase in salary from £1,000 to £1,200.

Mr. A. A. Allen has been appointed a member of the Highways Committee of the London County Council to fill the vacancy caused by the resignation of Mr. J. Skinner.

Mr. J. H. Menzies, on leaving Dundee to take up the duties of general manager of Kilmarnock Corporation Tramways, has been presented with a purse of Treasury notes.

Mr. F. Dudley Docker has resigned the chairmanship of the Metropolitan Carriage, Wagon and Finance Company, Limited. **Sir Ernest Hiley,** deputy chairman, has succeeded him.

Mr. Emile Garcke at the meeting of the British Electric Traction Company announced his resignation of the chairmanship of the company. He will, however, remain a member of the board.

Mr. James Dobson, general manager and engineer of Southampton Corporation Tramways, has been granted an increase in salary to £900, rising by two annual increments of £50 to £1,000 per annum.

Mr. Leonard Boyce Goodyer, son of Mr. T. B. Goodyer, tramways manager, Croydon, has recently been successful in passing his intermediate and final examination for the Institute of Chartered Accountants.

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Major W. E. Simnett, M.B.E., Assoc. Inst.C.E. (late R.E.), has retired from the direction and editorship of *The Technical Review* on his appointment to direct the Intelligence Branch of the Ministry of Transport.

Mr. Robert McLeod, chief clerk of Edinburgh Corporation Tramways office, has been appointed traffic superintendent by the Council, in succession to Mr. W. P. Young, who has become manager of Dundee Corporation Tramways.

Mr. G. W. Kettlewell has resumed his duties as director of Baxter and Caunter, Limited, after an absence of three years, during which he has been engaged upon work for Government. **Mr. L. G. Caunter,** owing to ill-health, has retired from the Board.

Mr. William G. Turner, chief assistant engineer of the Newcastle and District Electric Lighting Company, has been appointed borough electrical engineer of Southampton, at a salary of £1,000 per annum. There were 54 applicants for the position, and of these six were interviewed by the committee.

Mr. H. Mensforth, general manager of the works of the Metropolitan Vickers Company, has been appointed Director-General of the Government factories at Woolwich, Enfield, Gretna, Lancashire, etc., and will begin his new duties on August 1. Mr. Mensforth had been with the Westinghouse Company for the past 16 years.

Mr. James Mitchell, president of the Alabama Light, Power and Traction Company, who recently died in New York, was formerly associated with Dr. Pearson in the San Paulo Electric Company and the Rio de Janeiro Light and Power Company. He was identified with the Alabama Company since its incorporation in the laws of Canada in 1912.

Mr. E. T. Ruthven Murray proposes to engage in private practice as a consulting engineer, and has consequently resigned his appointment as general manager and engineer to the North Metropolitan Electric Supply Company, Limited. He will continue his connection with the company as constructional engineer. Mr. Murray's address will be Manor House Offices, Finsbury Park, N.4.

M. T. G. Richardson, manager of the Colne Corporation Light Railways, has been appointed general manager of the West Hartlepool Corporation tramways and omnibus undertaking. Mr. Richardson has been engaged in tramway work for 20 years, the first 13 being spent with the Bradford City Tramways, and the remaining period as general manager and engineer of the Colne Corporation Light Railways.

Mr. W. E. Walker, managing director of the Vulcan Company of Southport, has left England for New York on the *Celtic*. As the liner passed Liverpool bar lightship he was wished *bon voyage* by Mr. Wardman from the Vulcan-engined yacht *Crusada*. Mr. Walker intends to make a considerable tour in Canada studying local trade conditions on behalf of his company, who are now in a position owing to their production to set aside a number of vehicles for export.

TRAMWAY AND LIGHT RAILWAY NOTES.

ABERDEEN.

POLICE PRIVILEGES WITHDRAWN AT ABERDEEN.

Aberdeen Tramways Committee has rescinded the privilege given to the police of travelling on the cars for any distance for 1d. Hereafter the police will pay the ordinary fares.

BLACKBURN.

SUNDAY SERVICES RESUMED.

The Corporation tramways are now giving a 40 minutes' service on some of the routes on Sundays. The regular Sunday service was suspended in August, 1918.

BIRMINGHAM.

REDUCTION OF STOPPING PLACES.

Declining a request from residents for an additional tramway stopping place on one of the routes, the Birmingham Tramway Department state that the unnecessarily frequent stopping of tramcars increases the use of motor power and adversely affects the running time. For this reason the Tramway Committee found it necessary some time ago to reduce the number of stopping places.

BRADFORD.

ONE-MAN DOUBLE-DECK RAILLESS CAR.—TRACK RENEWALS.

The Bradford Tramways Committee have approved a drawing submitted by the general manager (Mr. R. H. Wilkinson) for a one-man railless car with an upper deck, and have instructed him, subject to the approval of the Ministry of Transport, to proceed with the construction of the vehicle. The Tramways Committee of the Bradford Corporation has passed a resolution recommending the City Council to sanction the carrying out of renewals to the tramways track at a total estimated cost of £54,438.

CARDIFF.

FINANCIAL POSITION AND TRACK MAINTENANCE.—FINE FOR INTERFERING WITH CAR SEATS.

At a meeting of the Electricity and Tramways Committee on July 26, it was decided to ask the city treasurer and the tramways manager to submit a report on the financial position of the undertaking at the next meeting. The city treasurer was also asked to report on the length of track that requires to be relaid. At Cardiff Police Court, on July 8, two passengers were summoned for interfering with a car by reversing a seat back the wrong way and for obstructing the use of seats by other passengers. Two police officers were called on to the top of the car, which was held up for a quarter of an hour. The magistrates fined the defendants 40s. on each summons and ordered the payment of witnesses' costs.

CHESTERFIELD.

WOMEN DRIVERS RELEASED.

Chesterfield Tramways Committee have instructed the tramways manager to release the remaining women drivers on the Corporation cars as soon as possible.

EXETER

THREE-HALFPENNY FARE AND NEW CARS.

Exeter Tramways Committee propose to apply to the Ministry of Transport for authority to charge a minimum fare of 1½d. The purchase of two new cars at £2,275 each is recommended.

GLASGOW.

RAILS FOR TRACK RENEWAL.

Glasgow Corporation Tramways Committee propose to relay 14½ miles of track by the end of the year. The present stock of rails will be exhausted by the end of September, but it is expected that under the new contract made with the United States Steel Products Company a new supply will be available by that time. The price is £23 10s. a ton against the British quotation of £28. The present price is a little over £5 a ton more than that of last year.

GLOUCESTER.

INCREASED CHARGE FOR SPECIAL CARS.

Gloucester Electricity and Light Railways Committee have decided to increase the charge for special cars from 15s. to £1 per car for those used only within the city, and from £1 to 25s. per car when the cars are used beyond the city.

HUDDERSFIELD.

DEMAND FOR VESTIBULE CARS.

The question of providing glass screens on tramway cars for the protection of motormen was discussed at the annual conference of the United Vehicle Workers' Union in Nottingham. Mr. Yates, of Huddersfield, urged that the union ought to force employers to improve the working conditions of drivers. It was an absolute disgrace that men should have to stand eight hours on the front of a tramcar in a snow storm. Mr. Cliffe, of the Executive, expressed the opinion that what was wanted was not screens but vestibule cars.

LEICESTER.

SCHEME TO RELIEVE TRAFFIC CONGESTION.

A scheme has been presented to the Leicester City Council to widen Granby Street, Gallowtree Gate, and Belgrave Gate in order to remedy the congestion of traffic. The undertaking is estimated to cost £900,000. Ald. Yearley, in moving the acceptance of the proposal, said the scheme would make possible an extension of the tramways from which a handsome revenue might be expected. The scheme was approved, and it was decided to apply for Parliamentary powers.

LIVERPOOL.

TROLLEY BOYS.

The Corporation Tramways Committee at Liverpool has decided to recommend the adoption of the trolley boy system in the city to enable conductors, as the *Liverpool Courier* puts it, to "keep an eye on the fare dodgers."

NEWCASTLE.

SUCCESS OF RECENT FARE REVISION.

Since the new scheme of fares, recommended by the general manager (Mr. E. Hatton), was introduced in Newcastle in May last, there has been a marked increase in receipts. The increase has been at the rate of about £600 per week with practically no decrease in the number of passengers carried. Although some criticism was made when the new fares were first introduced, the public readily accepted the scheme as necessary to meet the increased wages bill. The 1d. fare is still the minimum.

NOTTINGHAM.

TRAMWAYS HELP LOCAL HOSPITAL.

The Notts. and Derbyshire Tramways Company made a special effort on behalf of the Nottingham General Hospital on Saturday. Envelopes were supplied to passengers in which to place their contributions, and the numbers of their tickets were written thereon.

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The owner of the ticket corresponding to a number drawn will have a free week at Blackpool. Capt. Morland, manager of the tramways, was the originator of the scheme, and the proceeds for the hospital realised £121 3s. 3½d.

PLYMOUTH.

TRAMWAYS EXTENSION AND OMNIBUS POWERS.—CONGER EEL STOPS TRAMWAY SERVICE.

The Tramways Committee have recommended the Council to obtain statutory powers in respect of an extension of the tramways for the purpose of linking up Morice Square terminus with the Union Street line extension of tramways from Tor Lane and Compton to Crownhill, and the provision and maintenance of omnibuses to run within a radius of 15 miles from the borough boundaries. At a meeting of the Town Council, Alderman Love, chairman of the Electricity Committee, said the recent stoppage of current to the tramways which held up the system for an hour was due to a large conger eel having got into the force pump at a generating station and choked it.

SHEFFIELD.

COMMITTEE APPROVES MANAGER'S ACTION.

The committee of Sheffield Town Council appointed to inquire into the charges made by Councillor Womersley of certain alleged unfair and unjust promotions in the tramway service, came to the unanimous conclusion that no case had been proved of unfair or unjust promotion in the tramway service without due consideration for merit and length of service. The committee remarked that in a department of the size of the tramways and motors department there was of necessity bound to be disappointment on the part of some employees in connection with promotions, but the committee were of opinion that the promotions questioned were made in the best interests of the department and without any ulterior motive. The committee are of opinion that the imputations made against the general manager and members of his staff are entirely without foundation The committee are also of the opinion that the complaints made by Councillor Womersley were made in good faith, but without Councillor Womersley understanding the seriousness of such complaints.

SOUTHEND.

AN APPEAL FOR STRAPS.

At a meeting of Southend Light Railways Committee, a letter was read from the hon. secretary of the Southend and District Railway Travellers' Association, asking that additional straps should be provided in the interior of the tramway cars for the convenience of the passengers. The town clerk reported that he had informed the association of the steps already taken by the Corporation to obtain additional rolling stock, the delay in the delivery of which had been brought about by causes beyond the control of the contractors, and it was resolved that the Electrical Engineer be instructed to provide such additional straps in the interior of the cars as may be considered necessary.

WALTHAMSTOW.

A RECREATION HUT.—"SAFETY FIRST."

A new recreation hut for the Walthamstow Tramways Employees' Recreation Club was formally opened early in July by Mrs. West, wife of Councillor J. W. West. During the evening Mr. William Murray (manager) referred to the work of the Safety First Council, and said he was proud to know that a larger proportion of men at Walthamstow had won awards of the Council than in any district throughout London.

WEST BROMWICH.

LOW PRICE FOR CURRENT.

Complaint was made at the meeting of the West Bromwich Town Council last week that the tramway company had a contract for electricity from the municipality which acted unfairly on the latter. The company was taking more current than ever before, and only paid 1d. per unit, which represented a considerable loss. The company, with a favourable agreement, was able to run tramcars outside the town on current for which it paid half the cost of generation. The committee was unable to get any alteration of the terms until the termination of the contract.

WREXHAM.

PRIVATE OMNIBUS COMPETITION.

The chairman and manager of Wrexham and District Electric Tramways, Limited, attended a meeting of the General Purposes Committee of the Wrexham Town Council recently and pointed out the seriousness of the competition of motor cars and omnibuses run by private individuals. If the Council would refuse to licence cars to run over the tramway route they would be able to give a 15 minutes' service of cars to Rhos, instead of the present 23 minutes' service. If the omnibus competition were stopped they would guarantee the Corporation an additional sum of £500 a year for current. Sir Leonard Roland said he did not believe in crushing out the enterprise of the owners of small cars to increase the profits of the company, and consideration of the matter was deferred.

CONTRACTS AND ORDERS.

Edgar Allen and Company's tender for tramway rails has been accepted by Leyton Council.

Macintosh Cable Company's tender for cable at £625 8s. has been accepted by Salford Corporation.

The General Electric Company are supplying a 500-KW. rotary converter at £3,838 to Great Yarmouth Corporation.

Bolton Tramways Committee have accepted the tender of Hadfields, Ltd., for the supply of tramway points and crossings.

Babcock and Wilcox, Limited, are supplying three water tube boilers, economisers, etc., for Lister drive power station, Liverpool.

The English Electric Company are to supply three double-deck tramcar bodies at £6,462 to Wolverhampton Corporation Tramways.

The British Thomson-Houston Company are to supply sixteen 249A motors at £6,462 to Wolverhampton Corporation Tramways.

Grimsby Corporation have accepted the tender of Johnson and Phillips, Limited, at £3,603 15s., for the supply and laying of E.H.T. feeder and pilot cables.

The Brush Electrical Engineering Company's tender for eight single-deck cars at £14,784 has been accepted by Wolverhampton Corporation Tramways.

The Western Electric Company are carrying out the installation of a traffic control telephoning system for the Plymouth Corporation Tramways, the price being £584.

Leeds Electricity Committee have accepted the tender of the British Thomson-Houston Company for a 12,000-KW. turbo-alternator and condensing plant at £134,450.

J. W. Courtenay, Limited, of Amberley House, Norfolk Street, London, W.C., have been appointed sole advertising contractors to the Dundee, Broughty Ferry and District Tramways Company.

The Brush Electrical Engineering Company have arranged a contract with Great Yarmouth Corporation for a 1,400-KW. turbo-generator at £20,710, and for a 500-KW. frequency changer at £4,902 10s.

The Consolidated Construction Company's tender, amounting to £202,275 19s. 9d., for the construction of tramway track work and improvement works along the route from Mare Street to West India Docks has been accepted by the London County Council. The figure for the track work is approximately £176,320.

Derby Town Council have been recommended to accept the tender of Scholey and Company, Limited, amounting to £12,516, for treating by the insitu rail hardening process the tramway rails. Another tender recommended for acceptance is that of the Rail Welding Company, amounting to £1,833, for the electric welding, retreading and grinding joints.

Bradford Tramway Committee have accepted the tenders of Cammell Laird and Company, Limited, for 50 nickel chromo-steel axles at £515 13s. 6d.; J. Brown and Company, Limited, for 200 steel tires for car wheels, £1,665 12s. 6d., and the National Rail and Tramway Appliances Company, Limited, for 6 tons cast-iron brake shoes for £161 14s.

Southend Light Railways Committee have accepted the tender of the Metropolitan Vickers Electrical Company, Limited, for the supply of Westinghouse electric magnetic track brakes for 12 cars (for which new motors are now being made) at prices amounting to £2,460. The electrical engineer reported that it was necessary to reconstruct the brake gear of 20 existing cars, and he suggested the purchase of 20 sets of hand-brake gear, in order that the work might be put in hand during the coming winter, so that by next season there will be 12 cars with new electric motors and 20 cars with new brake gear. These, together with the 13 new cars now on order, will enable 45 cars to be put into service in thorough running order. The committee accordingly approved the tender of the Brush Electrical Engineering Company for the supply of 20 sets of hand-brake gear.

The London County Council have accepted the tender of Brown, Bayley's Steel Works, Limited, for the supply of 4,000 driving wheel tires and 3,500 trailing wheel tires for electric cars. The following were received—

	Quantity offered.	Price for each Driving Wheel.	Quantity offered.	Price for each Trailing Wheel.
		£ s. d.		£ s. d.
Brown, Bayley's Steel Works, Limited	4,000	5 1 3	3,500	4 3 6
John Baker and Company (Rotherham), Limited	4,000	5 1 3	3,500	4 3 6
Cammell Laird and Company, Limited	4,000	5 1 3	3,500	4 3 6
H. Bessemer and Company, Limited	4,000	5 1 3	3,500	4 3 6
John Brown and Company, Limited	4,000	5 1 3	875	4 3 6
United Steel Company, Limited	4,000	5 1 3	—	—
Monkbridge Iron and Steel Company, Limited	2,000	5 3 3	1,000	4 8 0
Vickers, Limited	4,000	6 0 0	3,500	4 15 0
Steel, Peach and Tozer, Limited	4,000	6 6 9	3,500	4 15 9
Bochumer Verein Steel Works	800	6 10 0	700	4 10 0

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PATENT LIST

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Fishplates for rails (17,512)—W. S. Backen.
Motor vehicles (18,406)—V. G. Barford and J. I. Thornycroft and Company.
Differential steering gear for motor vehicles (18,005)—S. Bennett and H. I. Palmer.
Undercarriages of tramcars (18,009)—G. A. Bishop and R. A. Chadwick.
Direction indicators for motor vehicles (17,788)—C. Bryant.
Steering mechanism of motor vehicles (18,441)—W. A. Chamberlain and J. Ireland.
Lifting jacks (17,845)—W. A. Chapman.
Electric vehicles with storage batteries (17,556)—A. Couaillet.
Front wheel driving mechanism for motor vehicles (18,125)—Daimler Motoren Ges.
Rail anchoring devices (17,771 and 17,785)—L. O. Henggi.
Steering wheel drive for power vehicles (17,905)—Horchwerke Akt.-Ges.
Driving gear for rear wheels of power vehicles (17,906)—Horchwerke Akt.-Ges.
Rail anchors (17,915)—W. J. Mellersh-Jackson (*P. and M. Company*).
Rear axles for motor vehicles (18,099)—C. W. Kelsey.
Lifting jacks (18,437)—C. F. L. King.
Rail braces (18,513)—J. G. Mueller.
Self-propelled vehicle electric starting apparatus (17,667)—T. W. Robson.
Starting and lighting apparatus for self-propelled vehicles (19,807)—V. G. Apple
Rail joints (19,545)—Block and Company Ges. fur Bahnoberbau
Electrically driven vehicles (19,850)—British Thomson-Houston Company.
Safety guard for wheels of motor cars (19,621)—G. B. Davis.
Power transmission for motor vehicles (18,688)—J. B. Entz.
Radiators for motor vehicles (18,946, 20,711 and 20,712)—H. Junkers.
Safety guard for automobiles (20,350)—M. Neesen.
Cooling motors of motor vehicles (19,503)—A. L. O. Poignard.
Lifting jacks (19,505)—H. Rabagliati.
Fuel valve gears for motor vehicles (19,359 and 19,360)—W. Seck.
Tramway lines (19,386)—C. E. Thomas.
Trailers for motor vehicles (18,950)—A. H. Treloggan.
Brake mechanism for vehicles (21,562)—A. G. Barnett.
Fuel feed apparatus for motor vehicles (21,519)—C. Binks.
Motor vehicles (21,300)—E. W. Bowen.
Driving gear of motor vehicles (21,137)—F. J. Bradbury.
Means for retaining trollies on wires (21,128)—L. F. Brommage.
Bow collectors for electric vehicles (20,505)—C. Conradty.
Spring suspension of motor vehicles (21,503)—L. E. Cowey.
Change speed mechanism for motor vehicles (21,212)—T. J. Daly.
Driving wheel carriage for motor vehicles (20,816)—Hansa-Lloyd-Werke Akt.-Ges.
Electrically driven vehicles (20,817)—Hansa-Lloyd-Werke Akt.-Ges.
Chassis of motor vehicles and mounting of motor bodies thereon (21,574)—C. L. Heyermans.
Live axle for motor vehicles (21,575)—C. L. Heyermans.
Control device for points of tramway tracks (21,508)—P. Hoeven.
Spring suspension for motor vehicles (20,601)—M. Jurist.
Trollies for overhead electric tramways (21,231)—W. Lawrance.
Trolley wheel and guides (21,468)—S. D. Master.
Rail supports (21,187)—O. Valeri.
Electrically driven vehicles (21,341)—F. M. Walters.
Coupling apparatus for tramway vehicles (21,448)—A. Wren.
Steering columns for motor vehicles (22,010)—B. J. Grigsby.
Journal box jacks (21,866)—J. A. Hope.
Route indicators for road vehicles (21,998 and 22,000)—J. Joseph.
Means for improving electrical contact between collectors and conducting rails of electric railways, etc. (21,860)—W. H. Lawes.
Steering gear of motor vehicles (22,151)—L. Sample.
Motor vehicles (21,611)—R. J. Urquhart.
Speed gear for self-propelled vehicles (21,691)—S. C. Westall.
Clutch mechanism for self-propelled vehicles (21,692)—S. C. Westall.
Life guard (21,629)—D. Wightman.
Signalling devices for street crossings of tramways (21,598)—E. and R. Zellweger.
Motor vehicles (22,680)—J. E. V. Millbank.
Motor vehicles (22,347)—E. M. Munro.
Trollies of overhead electric cables (22,439)—J. W. Player.

SPECIFICATIONS PUBLISHED

1918

Jacking apparatus (15,645—*145,096*)—W. F. Cottrell.

1919

Supporting device for overhead electric trolley wires (1,985—*143,946*)—F. W. Fawdry and P. Dawson.
Track brakes for tramcars (12,200—*144,064*)—J. Lacey.
Four-wheeled motor vehicles (13,862—*144,086*)—S. B. and J. Weller.
Power transmission mechanism for motor vehicles (26,366—*144,180*)—D. N. Quertier.
Trolley heads for electric tramcars (27,026—*144,183*)—F. Sharp and J. Martin.
Lifting jacks (30,996—*144,202*)—G. H. Morris.
Electrically operated engine starters for self-propelled vehicles (5,617—*144,369*)—F. J. Gill.
Friction driving mechanism for motor vehicles (5,913—*144,380*)—C. F. Beauvais.
Engines and transmission systems of motor-driven vehicles (11,118—*144,444*)—J. Y. Sangster.
Trolley wheel fittings for trolley poles (12,530—*144,456*)—C. W. Mallins and J. P. Barker.
Means for controlling motor-driven vehicles (31,691—*144,567*)—G. Fornaca.
Life guards, brakes, clutches, and other control arrangements for motor vehicles (4,332—*144,758*)—D. Roche.
Motor road vehicles (6,475—*144,788*)—J. A. J. Evans.
Power operated propelling rams for tramway systems (6,600—*144,797*)—McKenzie, Holland and Westinghouse Power Signal Company and F. M. Castleman.
Driving mechanism for motor vehicles (14,769—*144,872*)—E. J. Kane.
Tramway rails (15,595—*144,878*)—J. P. Hitchcock.
Motor vehicles (17,364—*144,894*)—A. J. Stevens and Company and H. Stevens.
Jacks (20,679—*144,924*)—H. I. Benedict.
Spring suspension for motor vehicles (16,242—*145,262*)—G. Fornaca.
Transmission gearing for power-driven vehicles (8,351—*145,888*)—T. L. Davies and E. W. Bowen.
Bodywork frames for use on motor vehicles (8,846—*145,898*)—Daimler Company and H. C. Inskeep.
Motor vehicles (13,809—*145,951*)—T. Foulkes.
Jacks (18,400—*145,991*)—F. W. Apperley and J. H. Bridson.

1920

Hanging straps for public vehicles (4,203—*144,984*)—P. R. J. Willis (*A. T. Johnson*).

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1919. WEEKS ENDED					1920. WEEKS ENDED.					AGGREGATE.		
	July 5	July 12	July 19	July 26	Aug. 2	July 3	July 10	July 17	July 24	July 31	Wks.	1920.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare Corporation	521	...	...	479	...	627	...	...	631	...	...	...	...
Aberdeen Corporation	3,383	3,281	3,515	4,096	3,755	4,028	3,965	4,170	5,295	5,445	8	35,812	- 6,159
Ayr Corporation	807	936	1,111	2,091	1,083	766	1,003	1,275	2,188	1,221	11	10,585	- 6
Barrow Corporation	794	838	887	917	897	952	895	976	1,006	982	17	14,907	- 832
Belfast City Tramways	10,323	10,753	9,924	9,714	10,374	11,465	11,981	11,791	11,178	10,924	18	209,333	- 25,200
Birkenhead Corporation	2,964	2,896	3,014	3,050	3,037	3,548	3,526	3,611	3,466	3,610	17½	60,107	- 10,475
Birmingham Corporation	24,890	25,926	24,437	24,703	24,966	28,104	27,869	33,509	33,942	32,316	18	504,254	- 43,587
Birmingham Motor 'Buses ...	1,528	1,805	1,708	1,656	1,721	1,967	1,913	2,177	2,167	1,963	18	35,760	- 4,594
Blackburn Corporation	2,164	2,471	2,290	2,229	2,565	2,644	2,458	2,800	2,637	2,650	17½	45,742	- 2,864
Bradford Corporation	11,038	11,774	11,207	11,357	12,268	12,337	11,979	13,305	12,510	12,504	18	219,612	+ 14,977
Burnley Corporation	2,873	2,872	2,116	2,962	2,980	3,579	3,062	3,545	3,650	3,683	...	—	—
Burton-on-Trent Corporation ...	488	486	599	504	545	620	603	600	610	654	18	10,165	- 1,397
Bury Corporation	2,368	2,370	2,244	2,476	2,317	2,570	2,575	2,619	2,581	2,775	17½	46,361	- 2,716
Chatham and District	1,595	1,756	1,717	1,814	...	1,921	1,853	1,979	1,995	...	...	...	...
Cork Electric	742	765	763	785	816	889	955	862	805	706	30	25,046	- 5,719
Derby Corporation	1,963	1,982	1,684	2,011	1,922	2,326	2,187	2,355	2,409	2,415	18	39,224	- 5,163
Dundee City	2,584	2,618	2,541	2,920	2,880	2,821	2,956	2,694	3,045	2,926	10½	29,947	- 2,608
East Ham Corporation	1,805	1,952	1,944	1,864	1,935	2,062	2,051	2,082	2,164	2,041	17½	33,323	- 274
Edinburgh Corporation	13,413	13,135	12,595	14,534	11,560	15,342	12,552	12,563	15,412	13,596	11	144,939	- 4,542
Edinburgh Motor 'Buses	...	...	...	...	...	738	738	718	1,178	1,039	11	8,707	—
Glasgow Corporation	32,777	32,112	30,924	25,805	29,423	44,964	43,514	41,961	31,588	37,746	8½	368,938	- 95,465
Glossop (Urban Elec. Supply Co.)...	210	217	167	202	212	Nil*	124*	214	235	242	31	6,887	- 46
Huddersfield Corporation	4,731	4,780	4,984	4,712	4,883	5,457	5,016	5,360	5,380	5,383	18	84,894	- 3,017
Ilford U.D. Council	1,224	1,248	1,191	...	...	1,278	1,220	1,284	...	...	...	...	...
Ipswich Corporation	923	957	1,111	977	1,033	1,041	1,043	1,115	1,115	1,147	16	17,431	+ 1,360
Isle of Thanet...	1,460	1,676	1,719	1,710	2,107	1,814	1,708	2,250	2,419	2,500	43½	39,032	+ 9,856
Kilmarnock Corporation	279	272	308	331	343	395	390	408	454	465	11	4,197	- 801
Lanarkshire	4,142	4,186	4,154	4,718	3,741	4,466	4,494	4,400	4,312	3,661	30	125,044	- 19,752
Leeds City	...	...	...	...	...	...	...	...	...	...	—	—	—
Leicester Corporation	5,658	5,945	4,885	6,203	5,890	6,918	6,809	7,149	7,658	6,950	—	—	—
Leyton U.D. Council	3,044	3,135	3,179	3,096	3,169	3,052	3,046	3,069	3,232	2,966	18	55,049	- 1,748
Liverpool Corporation	23,096	23,988	24,131	24,447	23,799	28,764	28,125	28,920	29,369	28,152	30½	824,054	- 154,584
London County Council	82,150	82,454	80,803	82,819	80,268	86,087	85,976	85,343	87,161	83,554	17	1,439,665	- 54,580
Maidstone Corporation	406	432	375	356	390	556	505	528	565	495	17½	8,467	- 1,714
Manchester Corporation	30,265	30,960	30,340	30,477	29,388	34,955	35,188	36,368	35,844	34,262	18	528,295	- 9,932
Newcastle-on-Tyne Corporation ...	8,766	9,169	10,361	9,922	9,293	10,327	10,516	10,984	11,085	11,075	17	192,507	+ 22,887
Nottingham Corporation	6,862	7,319	7,057	7,307	7,095	7,800	7,743	7,845	7,899	7,776	17	133,580	- 7,615
Oldham Corporation	4,308	4,503	4,202	4,583	4,419	4,694	4,299	4,963	5,064	5,146	19	85,276	- 1,787
Reading Corporation	1,577	1,628	1,639	1,796	1,649	1,691	1,671	1,716	1,709	1,599	17	29,042	- 1,304
Reading Motor 'Buses	...	...	...	...	...	216	268	325	314	292	17	4,292	—
Rotherham Corporation	2,084	2,150	2,121	2,000	2,058	2,535	2,713	2,731	2,773	2,987	17	44,746	- 6,400
St. Helens Corporation	...	...	...	...	...	2,128	2,010	2,098	2,130	2,062	17	34,072	—
Sheffield Corporation... ...	16,480	16,650	15,881	17,112	16,625	20,401	21,125	21,720	21,334	21,255	18½	383,740	- 71,741
Southampton Corporation	2,784	2,795	2,722	3,313	2,515	3,471	3,295	3,453	3,643	3,587	17	54,750	- 6,599
Southampton Motor 'Buses ...	...	...	...	...	...	242	212	238	245	240	17	3,989	—
Southend Corporation	2,455	1,765	1,504	3,057	2,930	2,918	2,768	3,172	3,406	3,369	17	41,876	- 5,207
South Shields Corporation	1,914	1,891	1,201	1,510	...	1,319	1,366	1,961	2,039	...	...	...	...
Sunderland Corporation	2,829	2,790	2,514	3,106	2,957	2,915	3,142	3,214	3,394	3,389	18	54,642	+ 2,570
Swindon Corporation	382	335	350	453	399	389	324	368	402	389	17	64,696	- 308
Tyneside Tramways and Tramroads	2,932	1,176	1,269	1,434	1,434	2,059	973	1,200	1,217	1,217	3	3,391	- 488
Wallasey Corporation	2,550	2,745	2,775	2,931	2,965	2,549	2,542	2,791	2,892	2,918	17½	45,929	- 803
Walsall Corporation	1,314	1,367	1,339	1,320	1,330	1,695	1,739	1,789	1,742	1,746	18	30,634	- 6,709
Walsall Motor 'Buses	...	...	...	482	457	...	...	...	1,009	1,105	18	17,677	- 8,692
Walthamstow U.D. Council ...	1,578	1,686	1,699	1,605	1,767	2,123	2,000	2,158	2,263	2,010	17½	37,062	- 5,775
Warrington Corporation	928	880	815	691	873	1,065	975	935	960	984	17	16,896	+ 1,846
West Ham Corporation	5,272	5,299	5,222	4,834	5,226	5,365	5,393	5,398	5,511	5,383	17½	93,411	- 2,667
Wolverhampton Corporation ...	1,863	2,012	2,050	1,636	1,931	2,397	2,376	2,508	2,534	2,354	17	41,450	- 7,314

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1919. WEEKS ENDED.					1920. WEEKS ENDED					AGGREGATE.		
	July 5	July 12	July 19	July 26	Aug. 2	July 3	July 10	July 17	July 24	July 31	Wks.	1920.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	53,018	59,213	56,827	59,632	59,713	73,865	77,659	64,399	74,255	74,799	30	2,245,652	- 587,698
Calcutta ... ... Rs.	89,804	88,989	89,940	86,143	87,234	98,651	101,224	103,068	92,803	94,967	30½	2,818,162	- 237,058
Madras... ... ... Rs.	44,349	(2 weeks)	50,694	(2 weeks)	48,747	46,311	(2 weeks)	54,312	(2 weeks)	53,467	29	681,953	+ 129,469
Pernambuco	5,498	5,342	5,414	1,329*	4,091	6,042	5,810	5,997	5,723	5,698	30½	218,062	- 56,048

*Service suspended owing to Strike.

Companies issuing Monthly Statements only.

	1919.						1920.						Wks.	AGGREGATE.	
	Feb.	Mar.	April	May	June	July	Feb.	Mar.	April	May	June	July		1919-20.	+ or -.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	3,052	3,623	4,291	3,266	...	...	4,279	4,182	4,933	3,672	...	...	8	8,505	+ 1,046
Brazilian Trac. Mlrs	7972.000	9330.000	9208.000	9562.000	9369.000	...	9381.000	9900 000	10245000	10985000	10874000	...	26	61.040.000	+ 7,077.000
Brisbane	34,380	39.380	38.775	...	...	...	41.500	45.460	44.890	...	...	...	17	176.750	+ 25.640
British Columbia $	645.415	649.120	631.988	628.847	411.605	...	746.030	761.182	749.081	720.004	710.210	...	52	8.737.132	+ 1.674.573
Buenos Ayres L'c'z.	42.429	47.370	43.605	47.319	61.356	45.222	52.468	55.000	53.429	54.563	50.635	51.508	5	51.508	+ 6.286
Burma	35,926	38,440	36,814	38,900	41.516	44,050	41.814	45.117	44.673	46.785	50,471	52,289	52	551,957	+ 101.505
Cape Town ...	...	...	22,564	23.405	...	...	20.623	25.089	25.010	24.395	...	...	...	...	...
Carthagena & H. ...	2,351	2,400	1,786	3,226	3.373	4,183	4,008	3.493	5.482	5.313	5.562	4.164	31	32.770	+ 11.796
Cordoba	...	...	...	...	17.188	...	...	...	...	...	20 056	4.081	13	59.601	+ 8.306
East India ...	1,689	2.016	1.920	2.131	2,323	2.687	3.001	3.592	3.916	3.980	3,862	...	52	39.492	+ 14,803
Kalgoorlie	2.278	2.653	2.907	...	...	...	2.677	3.142	3.246	...	...	...	17	11.638	+ 1,238
La Plata	6,698	6.592	5.631	...	...	5.317	6.894	6.392	6.142	...	...	5,353	31	38,497	- 1.276
Lima	46.110	50.716	49.980	42.974	47.855	...	56.050	60.325	57.415	54.969	55.919	...	26	343.173	+ 60.167
Manila ... $	211,676	207,876	212.205	202,449	160.714	...	278.243	263.690	254,102	280,145	267.169	...	26	1.621.994	+ 395.488
Monte Video ...	...	...	...	37.382	34.750	34.039	...	...	...	42.401	39.989	39.647	39	386.935	+ 52.859
Para	23,248	26.022	25,342	24.503	24,647	...	24.303	24.883	24,771	25.842	25,403	...	30	173.920	+ 1,843
Peruvian ... $	...	1199,420	...	1059,150	...	...	...	1302.820	...	1287.070	...	...	—	13274.884	+ 1,966,779
Port Elizabeth ...	...	...	5.576	5.145	...	...	6.166	7.214	6.381	6.165	...	...	—	—	—
Rangoon	5.694	7.533	6.217	6.533	6.276	...	7.667	8.698	7.857	7.933	7.849	...	26	47.471	- 8.845
Toronto ... $	1015.797	1083.285	1051.960	1032.717	842.697	...	1113.717	1255.668	1211.708	1206.930	1127.239	...	26	7.045.748	+ 912.452
Winnipeg ... $	371,162	384,937	367,196	248,191	112.615	...	444.873	456.915	431.685	404.742	407.625	...	26	2.644.677	+ 770.037

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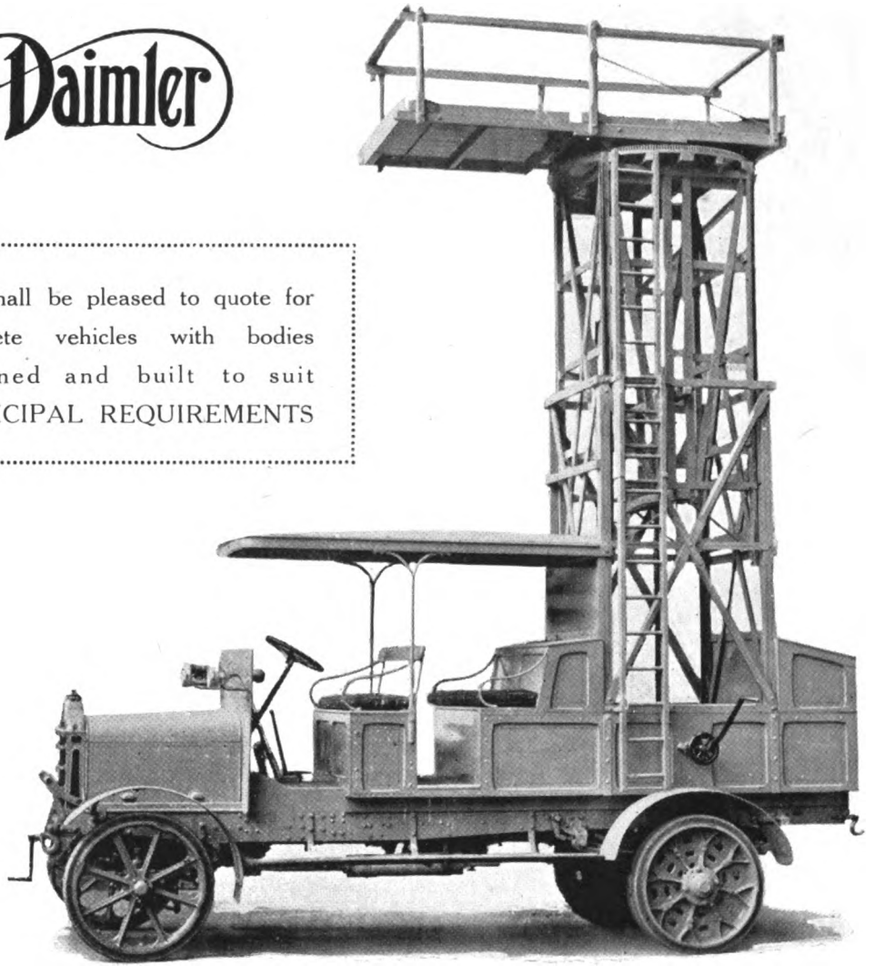

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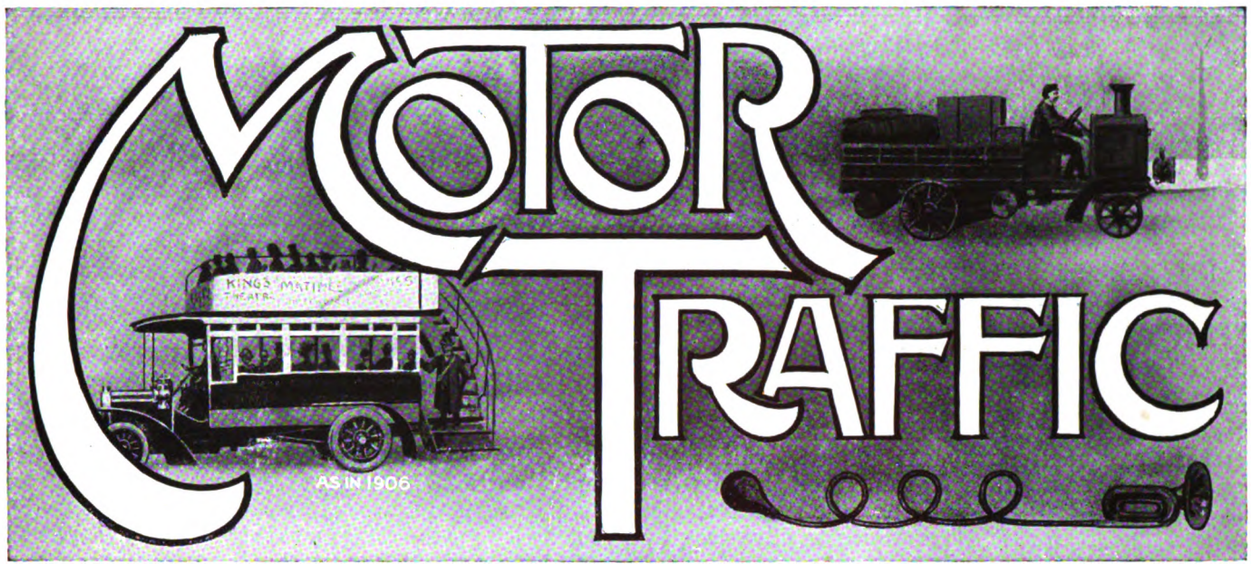

THE NEW TAXATION.

As was anticipated, the strenuous efforts made by motoring organisations to retain a system of taxation on fuel as opposed to a scheme of high licence duties have failed. The Government was determined to push its scheme through, and most unfortunately it was given support by a certain group of organisations using mechanically-propelled vehicles. For the most part these people are proprietors of town omnibus services, who are said to prefer the new scheme because their share of the burden is unduly light, and owners of steam vehicles who are not concerned either way, since their taxation must in any case be along the lines of the Government scheme. The group was, however, able to appear to represent commercial motor users generally, though it is an established fact that an enormous number of van, lorry, and coach owners much prefer the petrol tax coupled with a modified licence duty to the scheme that is to be enforced next year. The Government, of course, seized greedily on the slightest symptom of a lack of unanimity among motoring organisations, and made the most of the fact that this group went back upon the undertaking that it had previously given in a conference of all such organisations. Upon this one Committee—and it may be said probably upon a few individuals—rests the entire responsibility for the breakdown in the strenuous effort that has been made to secure unity of motoring policy. It is questionable whether the attempt will ever be repeated, the circumstances surrounding its failure being so unpleasant and the lesson learnt from it so unsatisfactory. If in the future we suffer from restrictive legislation or lack of official support at critical moments the position will be due mainly to this breakdown and to those who brought it about. The whole thing is lamentable, and it is not surprising that feeling runs high.

THE LEFT-HAND DRIVE CONTROVERSY.

At the time of writing the question of the future of the left-hand drive still remains unsettled. Licensing and traffic authorities throughout the country are strongly opposed to the use of vehicles with the steering wheel on the left. The general feeling of manufacturers and traders is also in opposition to this type, not because the left-hand drive vehicles are of foreign extraction, but on the grounds of first principles. A very unfair suggestion has been made in some quarters to the effect that the whole agitation has been deliberately engineered by the British motor industry to upset the importation of American cars. This accusation is quite groundless; British manufacturers, as such, have taken little or no part in the discussion. Moreover, the prohibition of the left-hand drive would not mean a prohibition of import of certain makes of car. It would merely mean that foreign manufacturers desirous of catering for the British market would be obliged, when constructing their vehicles for that purpose to embody at small cost certain modifications to fit the vehicles for the British market. In one instance firms in this country are offering to convert a certain foreign make of vehicle from left to right-hand drive for £18. The cost of making the alteration while the vehicle was still incomplete would, of course, be much smaller.

SIX-WHEELED VEHICLES.

Though various attempts have been made to design rigid six-wheeled vehicles, the mechanical difficulties connected with steering and the proper distribution of weight upon the wheels have always been very great, and progress has therefore been negligible. There are much greater possibilities in the articulating type that has often been described as the semi-trailer combination. In a sense this has been evolved from the tractor and trailer. Viewed from this standpoint it consists of a tractor on four wheels and a two-wheeled trailer, so attached that its forward end comes well over the rear part of the tractor. The two are connected by a turntable and springs, so that all the six wheels can accommodate themselves readily to inequalities of the road. Also the bulk of the weight carried comes over the driving axle, and therefore helps to secure adhesion. The system certainly has not many of the drawbacks of the ordinary tractor and trailer combination, but there has been some doubt as to whether it would not be legally classified as a tractor and trailer, in which case its legal speed would only be five miles an hour, and it would not be a good proposition for general use. A new six-wheeler on these lines has been recently exhibited and thoroughly tested, and examples have been licensed to run as six-wheeled vehicles. The registered weight on all axles is below six tons, and therefore the legal speed is 12 miles an hour. At the same time the total weight of the vehicle is less than four and a half tons, which

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MOTOR TRAFFIC

leaves seven and a half tons available for useful load. We have therefore a machine capable of legally carrying at 12 miles an hour a much greater load than would be possible on any four-wheeled vehicle of similar legal classification. There seems to be no serious mechanical difficulties in the proposition, and therefore there is at least a good prospect that the type will establish itself in favour for the heavier classes of haulage, and become a great asset in the attempt to secure cheap transport by road. An incidental merit is, of course, that the load-carrying portion can be detached and replaced by a duplicate, which may have been loaded up while the power unit was engaged in useful work on the road. Thus the system should be good under circumstances which involve lengthy loading and unloading operations.

DISORDERLY MOTOR COACH PARTIES.

During the past few weeks the Press has found itself in a rather difficult position owing to its desire to curse and to bless motor coach traffic with the same breath. That such matters should be treated not strictly on their merits but rather as newspaper "stunts" is, of course, a pity; but as long as the daily "sensation" is supposed to promote circulation a judicial view of motor questions can scarcely be expected. It is a coincidence that two simultaneous "stunts" should involve the expression of such very different views on the subject of the motor coach. On the one hand, we have had the outcry against increased railway fares in the holiday season, and tremendous play has been made of the possibilities of traffic being diverted from the railways to the roads. The superior attractions of road travel in motor coaches have been emphasised. So has the cheapness of such travel, and it has been indicated that the public would do well to transfer their patronage to it and to show those responsible for the increase of railway fares that higher fares do not necessarily mean bigger receipts. At the very moment when, in pursuit of this policy, it was evidently desirable to say everything that was charming about the motor char-a-bancs, a certain section of the users of this class of vehicle have given rise to an agitation of a quite different sort. Their disorderly and sometimes drunken behaviour has not merely outraged the sensibilities of people living along the roads that they use, but has caused positive danger to pedestrians and road traffic generally. Consideration of probabilities supports the theory that most of the trouble is due to the hiring out of vehicles to parties without the proprietor being represented during the trip and without any conditions being attached to the hiring. If coach proprietors will not take the necessary precautions, the local authorities in their respective districts can in practice coerce them into doing so, because there remains the power to refuse the renewal of licenses. Under the new scheme of taxation the man whose licence is withdrawn will have a right of appeal; but it is hardly to be imagined that an appeal would succeed if the reason for withdrawal were disorderly conduct on his vehicles owing to the laxity of the control exercised by him. Thus the local authority can make it a condition, and notify motor coach proprietors immediately to that effect, that it will not renew licences if repeated and authentic complaints are received of the behaviour of char-a-bancs parties. It would be possible to stipulate that a responsible representative of the proprietor should be present on all trips, and that no intoxicating liquor should be carried on the vehicles. A more difficult case is that in which the trouble originates on vehicles of the lorry-omnibus type, not licensed as hackney carriages but merely improvised out of ordinary goods-carrying vehicles. Such vehicles are probably engaged on their legitimate work during the week, but the proprietor may either lend them to his employees or hire them out to parties at week-ends. The bulk of the complaints are in respect of this class of vehicle. The remedy is to make things uncomfortable for the vehicle proprietor, and this can nearly always be done without difficulty if he does not take the trouble to see that his vehicles are not so used as to annoy or endanger the public. Rowdyism is in itself not a legal offence unless it passes certain limits; but it may nevertheless be highly objectionable. In that case it should be pointed out to the vehicle proprietor that if the machine is registered as a trade vehicle the carriage of passengers renders him liable to the payment of a heavy licence duty. Moreover, it does away altogether with his right to receive a rebate in respect of the petrol tax. His attention may also be drawn to the fact that the ordinary insurance policy for a trade vehicle does not cover risks to passengers, or in fact the use of the vehicle for the carriage of passengers at all. Thus if an accident happens, his liability may be very heavy.

PASSENGERS BY THE SIDE OF COACH DRIVERS.

In the House of Commons on July 12, Viscount Curzon asked the Minister of Transport whether his attention has been drawn to the fact that passengers in motor chars-a-bancs are allowed to sit alongside, or, in some cases, on both sides of the driver; whether this fact is likely to distract the driver's attention under certain conditions; and whether he will take power to extend the present regulations affecting motor omnibuses in London in this respect to all public service vehicles throughout the country?

Sir E. Geddes.—The suggestion contained in the last part of the question would require fresh legislation. The regulation relating to drivers of mechanically propelled public service vehicles has not yet been considered by the Departmental Committee. I cannot anticipate their report or the legislation which may follow it.

ROADS AFTER THE RAILWAY STRIKE.

The Essex county surveyor states in his annual report on the roads that for nearly four months during and after the railway strike of September, 1919, the main routes were traversed day and night by fleets of heavy lorries. This was at a time when the roads were least able to bear the strain, as maintenance had been retarded owing to the deficiencies of railway transport for the conveyance of granite. Thus incalculable damage was inflicted to all but paved surfaces. To restore only the London-Ipswich road—some 33 miles out of the 671 directly maintained by the County Council—an expenditure of £132,000 would be necessary, exclusive of the damaged bridges. The year had shown a phenomenal increase of omnibus routes, some roads having as many as six separate services. The Budget suggestions dealing with this subject would do something towards equalising the heavy cost to the ratepayers that these vehicles entailed, the bulk of it purely pleasure traffic. There would be a large outlay in repairing the damage done to railway bridges. The majority are 100 to 150 years old, brick built, and designed or strengthened to take stage coach traffic prior to railways. With the present heavy traffic it is extraordinary, the surveyor thinks, that the bridges are standing so well.

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MOTOR TRAFFIC

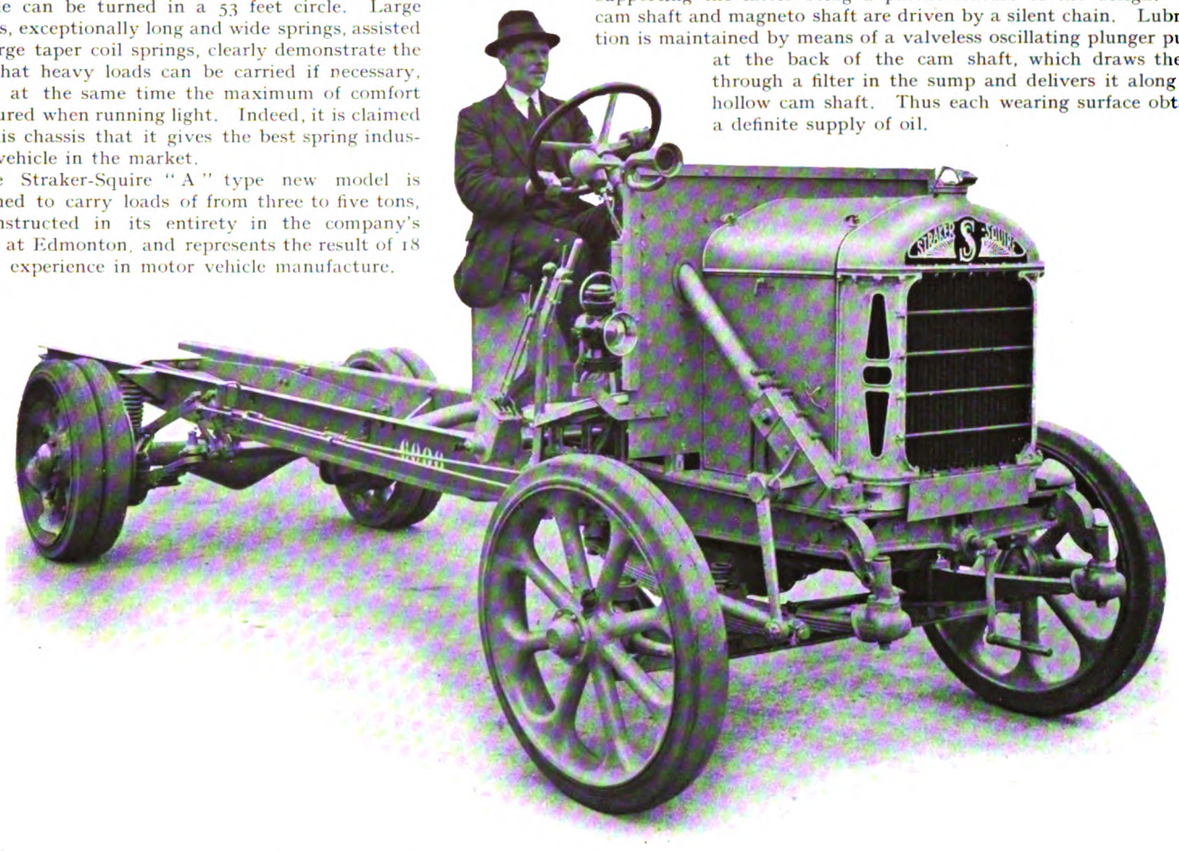
NEW STRAKER-SQUIRE CHASSIS.

ORIGINALITY OF THE "A" TYPE INDUSTRIAL MACHINE.

Inspection of the new industrial chassis which Straker-Squire, Limited, are offering, reveals at once commendable originality in its design. Quite apart from the fact that the novel type of power unit is one of its outstanding features, the general lay out of the "A" type is such as to favourably impress the experienced user. Owing to the special form of construction, whereby the driver is placed partly alongside the engine, a clear length of frame of 17 ft. 4 in. is given for the body work without excessive overhang, and this on a wheel base of 14 ft. 6 in. So ample is the steering lock that the vehicle can be turned in a 53 feet circle. Large wheels, exceptionally long and wide springs, assisted by large taper coil springs, clearly demonstrate the fact that heavy loads can be carried if necessary, while at the same time the maximum of comfort is assured when running light. Indeed, it is claimed for this chassis that it gives the best spring industrial vehicle in the market.

The Straker-Squire "A" type new model is designed to carry loads of from three to five tons, is constructed in its entirety in the company's shops at Edmonton, and represents the result of 18 years' experience in motor vehicle manufacture.

The four cylinders are cast as a single unit, the overhead valves and combustion chamber being in a separate detachable head and secured to the cylinder block by ten studs. Ample water space is provided and large jacket doors give complete access for cleaning. The crank shaft is of massive proportions, made from nickel chrome steel, heat treated to give 60 tons per square inch tensile strength. This runs in two 7 in. diameter roller bearings held in the crank case by steel caps. The crank pins and journals are 3 in. in diameter and the big end bearings are 2½ in. wide. The valves seat vertically in the metal of the cylinder head casting, and as there are no pockets the valves open direct into the explosive space. The valves are operated by tubular tappet rods and rocking levers, the method of supporting the latter being a patent feature of the design. The cam shaft and magneto shaft are driven by a silent chain. Lubrication is maintained by means of a valveless oscillating plunger pump at the back of the cam shaft, which draws the oil through a filter in the sump and delivers it along the hollow cam shaft. Thus each wearing surface obtains a definite supply of oil.



New Industrial Straker-Squire Chassis Notable for Originality.

FULLEST USE OF FUEL.—MINIMUM FRICTIONAL LOSSES.

Power with economy is the key note in the design of the power unit, which develops 54 H.P. at 1,000 revolutions. The cylinder bore is 4½ in., and the piston stroke 6½ in. The same features in the design which enable such a large power to be obtained from an engine of moderate dimensions make for fuel economy. According to the nature of the work to be done the chassis is supplied with two different back axle ratios—8 to 1 for heavy lorry work and very hilly districts and 7 to 1 for normal passenger vehicle duty.

On the lower ratio 7¼ miles to the gallon can be obtained with full load, and 8 miles to the gallon when running light. With the 7 to 1 ratio 8 miles to the gallon with a full 5-ton load has been obtained, while the consumption when running light gives upwards of 9 miles to the gallon. These figures are understood to be regularly obtained on the routine tests of all new chassis, so that it is reasonable to expect that under favourable circumstances they could be improved upon. The economy in oil consumption is equally good, the average being about 400 miles to the gallon. It is claimed that these excellent results are due to the highly efficient design of the overhead valve motor by which the fullest possible utilisation of fuel is secured and all internal frictional losses reduced to a minimum.

FEATURES OF THE TRANSMISSION.

Smith's four-jet carburettor is fitted as a standard; this is bolted direct on to the cylinder head and is heated by exhaust gases, which pass also under the inlet manifold. In this position it is very accessible and out of the way of mud and dust.

The single throttle valve is connected to a centrifugal governor on the magneto shaft, which prevents a speed of more than 1,300 revolutions being reached, and which cannot be disconnected without breaking the seals of the governor casing.

The large gilled tube radiator is mounted on rubber buffers on the cross member of the frame, it is built up of cast aluminium tanks and tube plates. Rapid circulation of the water is ensured by a two-bladed screw propellor driven by an attachment from the cooling fan. The high-tension magneto is fitted with an impulse starter, the effect of which ensures easy starting, no matter how slowly the engine is turned. A graduated adjustment is provided, this enabling the timing of the sparks to be set to close limits.

The clutch is of the single disc variety, 16½ in. in diameter, gripped between two rings of Ferodo fabric. A very efficient clutch stop is provided, and this, together with the low moment of inertia of the spinning portion, gives a smooth and shockless drive. The gear box is very compact, with short stiff shafts running on roller bearings

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MOTOR TRAFFIC

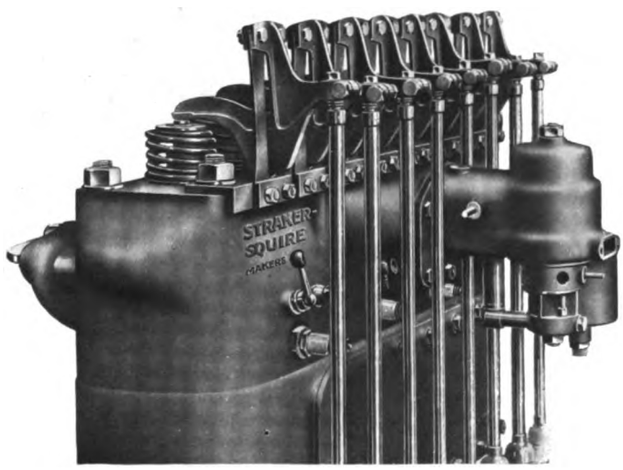
throughout. It gives four speeds forward and reverse. The usual "gate" and swinging lever is employed, the gate box being carried by an arm bolted directly to the gear box. A noteworthy feature of the design of the gear box is that although it is cast in one piece, giving very rigid construction, the lay shaft can be withdrawn intact with all its wheels and bearings, the gear box lid being held in position by a single thumb nut. The entire gear box can also be removed without dismantling the clutch.

The engine and gear box are mounted on a short stiff underframe, which is suspended from the main frame at three points only. This provides absolute alignment of engine and gear box, and enables the driving gear shaft to be fitted direct into the clutch centre.

The final transmission is by cardan shaft of 3½ in. solid-drawn steel tube, carried between universal joints of the star type, specially adjustable and easily demountable. The rear axle drive is through a worm and wheel running on roller bearings and ball thrusts. The road wheels run on steel sleeves 4 in. in diameter pressed into the axle casing. The road wheel bearings consist of phosphor bronze bushes of large size. The brake drums, of pressed steel bolted to the back wheels, are 22 in. in diameter with 3 in. face and lined with wire-asbestos fabric. Both brakes act upon these drums.

Improved Suspension.

A special feature has been made of the suspension of this chassis, which represents a marked advance upon previous practice. As already stated, the springs are both long and wide, but it is in the design of the spring support that the greatest departure has been made. The back springs are 5 ft. 6 in. long and 4 in. wide and take the driving torque and thrust, so that radius and torque rods are entirely eliminated; they are slung underneath the back axle by massive U bolts. At their front end they are fitted with hardened steel balls working in chilled iron cups lubricated by large snap-lid oil wells. At the back end a cast-iron slipper completely encloses the point of contact between the spring and its support. The two top leaves are of the same length, and mounted upon the upper surface of these is a hardened steel cup, into which fits a ball of the same material. By means of a hollow shank attached to the latter this is supported by the casing and lubrication is effected. It will be seen that by this method any movement of the spring is provided for. In order to keep the ball in position an adjustable screw is provided. The front springs are 4 ft. 3 in. long and 2¾ in.



Straker-Squire Engine.

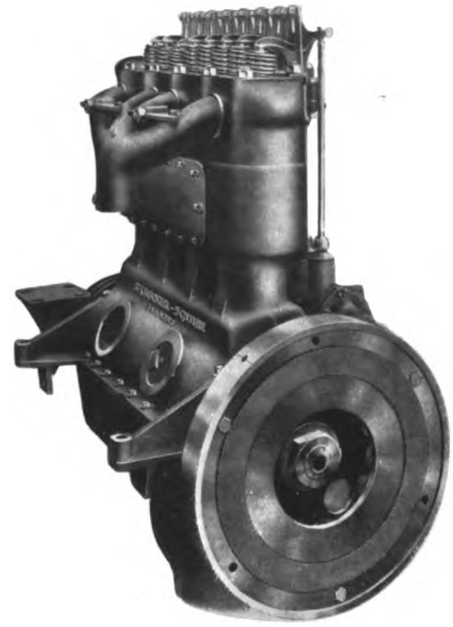
wide; at their forward end similar ball and cup supports take the place of the usual shackle and bolt, while the rear end is held in position by a swivelling ball attachment.

The taper coil springs are fitted to pressed steel brackets bolted to the frame; they take a big proportion of the weight when the vehicle is fully loaded and automatically stiffen up under big deflections.

The front axle is an I section drop stamping; the steering swivels turn in bushes in the axle jaws, which are as far apart as possible, the centre line of the swivels being close to the point of road contact. Hardened ball joints are used throughout, and as a result of the care taken in the design of these details remarkable ease of control has been obtained.

Although the weight of the chassis is less than some others of equal carrying capacity, exceptional strength is claimed for it. The frame members are 9 in. deep and ¼ in. thick, with flanges 2½ in. wide facing outward. By this arrangement the cross members are shorter and consequently stiffer.

The very highest quality of material is used throughout and it is this fact that has contributed largely to the excellent results which



Straker-Squire Engine.

have been obtained. Every part of the chassis is constructed from steel made to the actual specification best suited for the work it has to perform. No mild steel bolts are used; the majority are made from the Air Board specification, while special bolts, such as those used on the connecting rod are of nickel chrome steel.

Extent of Tests.—Ease of Dismantlement.

The net result of this selection of material has enabled Messrs. Straker-Squire to produce a chassis which, although weighing only 3 tons 7 cwts., has been tested over considerable distances with loads up to 6¼ tons.

A point of importance when the cost of upkeep is considered is the attention to detail which is noticeable in the design. The robust nature of the general design and the quality of the materials employed, guarantee a long life to the working parts. In addition, care has been taken to arrange that the minimum of attention is required to keep the vehicle in running order. In this connection it may be mentioned that all the joints of the road springs are lubricated by large oil cups fitted with spring lids, the idea being that it is much more satisfactory to inject a squirt of oil into each of these with the pump oil can provided, a task which requires only a few seconds, than to fill up the grease cups usually provided.

Another important feature is the ease with which the chassis can be dismantled for complete overhaul or the adjustment of any particular unit. The engine, mounted upon its sub-frame, complete with gear box, clutch, and operating mechanism, can be removed as a unit in a very short time, and if necessary replaced by another complete unit while the first is undergoing a thorough examination. The gear box can be taken out as a separate unit in a few minutes by removing four bolts, and by taking off four other nuts. Adjustment of the change-speed mechanism can be effected while the box is out of the frame. The propeller shaft, complete with its universal joints, can be removed as a unit by detaching two bolts only, without exposing any of the working parts to dirt or grit, while the worm gear and differential can be lifted out of the axle without jacking up the car. The advantage of these facilities is that all major adjustments and replacements can be dealt with on the fitter's bench instead of on the vehicle itself.

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MOTOR FUELS.

RESEARCH BOARD'S REPORT ON ALCOHOL AND GAS.

Sir G. Beilby, Director of Fuel Research, in issuing a report of the Fuel Research Board on July 16, stated that it is estimated there will be 750,000 motor vehicles in this country at the end of this year, and that in America the number registered is several millions. A considerable portion of the report is devoted to the possibilities of power alcohol production, and in connection with an investigation thereof Sir F. Nathan was appointed in December last to take charge of the work. Appended are extracts from the report :—

The enormous and rapidly increasing consumption of liquid fuels is tending to exceed production, and it is therefore a matter of great importance to develop the use of new fuels in every possible way. In 1919 the world's production of crude petroleum was 17½ thousand million imperial gallons, and although the United States contributed 13 thousand million gallons, or about 74 per cent., its consumption exceeded this quantity.

Internal combustion engines used for road and air transport are run largely on the light distillates of crude petroleum, known as petrol, or in the United States as gasoline. Petrol employed for these purposes in this country is almost entirely imported ; the quantities received in 1918 and 1919 were 193 and 200 million gallons respectively, and the estimate for this year is 250 million gallons. For certain classes of vehicles liquid fuel of properties similar to those of petrol is essential ; the liquid fuel which is most suitable in this respect is alcohol, probably mixed with ether or liquid hydrocarbons.

The liquid hydrocarbon already in use is benzol, and successful trials of mixtures of alcohol and benzol have been carried out by the London General Omnibus Company. Benzol can also be used itself. Benzol is produced in the manufacture of coal gas and in the working of coke oven plants. During 1918, when the gas undertakings were working to recover as much benzol as possible, the total output was about 10 million gallons, and in the same period the coke ovens produced about 32 millions. It is improbable that anything like the above quantity of benzol will be produced in the gasworks in future ; on the other hand, the output of the coke ovens might increase in time. The total production from both sources in 1919 was about 20 million gallons.

The main sources of alcohol are vegetable materials containing starch or sugar, and practically all the alcohol for potable and industrial purposes is now made from grain or molasses. Before the war large quantities of alcohol were made in Germany from potatoes specially grown for the purpose. Alcohol can also be produced from the fermentable sugars formed by the hydrolysis of wood cellulose, and synthetically from calcium carbide or from the ethylene contained in coke-oven and coal gas. The quantity of waste wood in this country for alcohol production is, however, negligible ; calcium carbide is impossible, as it cannot be produced in quantity without cheap power, and the recovery of ethylene from coke-oven and coal gas and its conversion into alcohol are still in the experimental stage. At the present time none of these sources of supply are of appreciable commercial importance in this country.

The production of alcohol in any considerable quantities from vegetable materials grown in the United Kingdom is not economically possible owing to (1) insufficient acreage, (2) the high cost of cultivation and harvesting, (3) the high cost of manufacture, and (4) the fact that the most suitable raw materials are also important foodstuffs. All matters in connection with the Empire production of power alcohol are being investigated, but even in the event of it being possible to produce alcohol in the Dominions and Colonies at a price at which it could be imported, distributed, and sold in this country, it must be a matter of time before supplies in any great quantity could be available.

In the tropical portions of the Empire if a cheap and simple process, either chemical or bacteriological, were available, and could be applied commercially on a very large scale, tropical vegetation would afford a practically inexhaustible reservoir of power alcohol. Steps have been taken for the initiation of research work in this direction, but it must take time, and even if a successful laboratory process is devised, a further period would be required for the establishment of factories, and for organising the many processes before supplies would be forthcoming.

In concluding a statement on the use of coal, the report summarises the position of that commodity as a source of motor fuel as follows—

(1) Coal is the largest as well as the cheapest source of fuels for transport purposes.

(2) Means are already in our hands for the "sorting out" of the potential energy of coal into forms of different availability and of different commercial value.

(3) The more volatile forms like benzol and light naphtha are so relatively costly that they ought only to be used for air transport or for the lighter and swifter forms of road transport. Their use for the heavier forms of transport is wasteful and unnecessary.

(4) Town gas and coke-oven gas are available in large quantities in most parts of the country, and might be extensively used in omnibuses and passenger cars for quick traffic if light and yet safe containers could be constructed, and if stations were established on the principal routes at which the containers could be quickly and easily replenished. If carbonisation of coal at temperatures about 600° C. becomes common, gas of twice the calorific value of town gas would be available for this purpose, so that twice the thermal units could be carried in the same containers.

(5) The coke produced by the carbonisation of coal at 600° C. is a tarless, smokeless fuel, easily lighted and easily kept alight, and would be admirably adapted for use in suction gas producers and engines. The cost of the thermal units produced in this way would not exceed 3s. per million, or one-seventh of the cost of petrol units with petrol at 3s. per gallon.

The committee have co-opted Mr. Sam Henshaw (National Benzole Association) and Professor H. B. Dixon (Manchester University) as additional members, and have appointed the following sub-committees—

Engineering.—Dr. W. R. Ormandy (chairman), Col. D. J. Smith, Mr. G. W. Watson, Mr. G. J. Shave, and Mr. F. G. Bristow (hon. secretary.).

Denaturation.—Sir Charles Bedford (chairman), Dr. W. R. Ormandy, Mr. Sam Henshaw, and Mr. F. G. Bristow (hon. secretary).

Sir James Dobbie, the Government chemist, has given the committee permission to reprint and circulate his report, furnished to Mr. Walter Long's committee last year, on "Denaturants and Denaturing," and as from August 1 the committee will undertake their own research in these branches of investigation.

THE INCREASED MOTOR TAXATION.

DEPUTATION TO THE MINISTER OF TRANSPORT.

Sir E. Geddes, Minister of Transport, on July 19 received a deputation from the Motor Legislation Committee on the subject of the Government's proposals with regard to motor taxation. The deputation, which was introduced by Sir W. Joynson-Hicks, consisted of representatives of all classes of motorists, motor vehicle manufacturers, and traders. The retention of the petrol duties as the basis for taxation was advocated, and the significance of the largely increased consumption of duty paying spirit during the past six months was impressed upon the Minister. Other points were raised, and Sir Eric Geddes promised to give the question his consideration.

SUCCESSFUL ROAD TRANSPORT.

"How to Make Motor Transport Pay" is the title of a 120 page booklet just published at half-a-crown by the Carriers' Publishing Company. The author, Mr. Hugh Miller, technical editor of the *World's Carriers and Carrying Trades' Review*, deals in a practical manner with the problem of mechanical road transport organisation and running costs. It is a reminder that there are actually people who expect to succeed in the road transport business without any previous experience that Mr. Miller should consider it necessary to emphasise that to secure success one must know the business. It is a dangerous plan to buy vehicles without having previously considered what they are going to carry, where they are going to carry, what the running expenses will be, and the basis upon which charges for hire are to be made. In developing his theme, Mr. Miller shows that buying a vehicle is not the first thing ; the wise man will survey the area he has in mind, study the existing facilities, and estimate the real chances of establishing a successful service. So the author goes on from stage to stage to give sound advice on all the practical issues involved. It is a treatise which should be in the hands of every man connected with the road transport industry.

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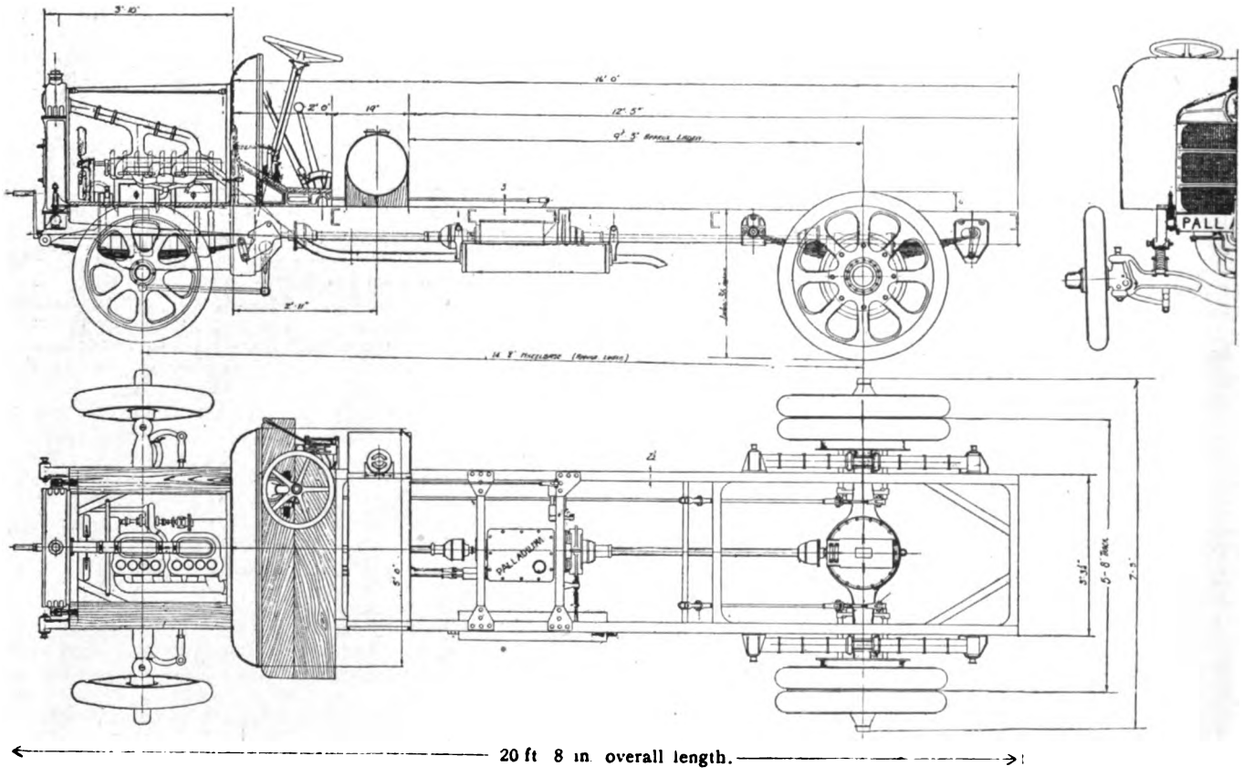
PALLADIUM CHASSIS IN THE GRIMSBY DISTRICT.

The Palladium chassis which was described in our issue of July 15 was supplied for the extensive motor coach traffic of the Great Grimsby Street Tramways Company. This 4-ton chassis has for several years also been successfully used by the Grimsby company for the omnibuses which serve outlying districts, and the running of the vehicles has been so satisfactory that an order was given to the Palladium factory at Putney for eight additional chassis. This order is stated by the Palladium Autocar Company to be in accordance with their experience that repeat orders follow tests. The tests at Grimsby were of a prolonged character, two Palladium cars being run for a period of four years during the war, when additional vehicles were not obtainable. For the running of a double-deck omnibus over extremely bad roads, and carrying full loads every journey, the cost of upkeep was found to be gratifyingly small. Tests were also made with other types, but the tramway company's chief engineer (Mr. H. Orme White) states that he had no difficulty in deciding where to place the order for the new vehicles. One of the omnibuses of the Grimsby company is here illustrated and the accompanying drawings show the design of the Palladium chassis.

One of a Fleet of Palladium Omnibuses owned by the Grimsby Tramways Company.



Plan and Elevation of the Palladium Chassis.

HAULAGE RATES IN LANCASHIRE.—It was reported at a meeting of the Liverpool Motor Haulage Contractors' Association that the organisation now comprises two-thirds of the haulage contractors in the city. The membership comprises 110 contractors with 280 vehicles, and a carrying capacity of 1,480 tons. Basic rates had been agreed with the three Manchester associations for the transport of goods between Liverpool, Birkenhead, and Manchester.

FIRST MOTOR COACH STATION.—The first motor coach station to be established is to be opened at St. Peter's Square, Manchester. Buck's Swift Fleet Motors, Limited, propose to run over forty motor coaches from this point at schedule times to seaside places. Mr. Buck, the managing director, explained that the station would in many ways resemble a railway station, and it was intended to provide waiting rooms, refreshment rooms, etc. There will also be a staff of porters to assist passengers.

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LICENSING OF MOTOR VEHICLES.

The Parliamentary Secretary to the Ministry of Transport, in the House of Commons on August 3, stated that in the Metropolitan police area motor coaches and other chars-a-bancs which ply for hire are licensed by the Commissioner of Police. In other towns and urban districts these vehicles are licensed under the Town and Police Clauses Acts, or in some of the larger towns, under private Acts of Parliament obtained by the Corporation concerned. The licensing authorities impose such conditions as they consider reasonably necessary for the safety of the public. Motor lorries do not require to be licensed, even though used occasionally for carrying excursionists or holiday makers, unless they ply for hire.

Asked by Viscount Curzon whether the conditions alluded to could be standardised between the Metropolitan police and local authorities throughout the country generally, Mr. Neal said that he had not given consideration to the matter, but he would do so. Licences to stand and ply for hire for motor coaches and chars-a-bancs are subject to conditions which the licensing authorities think fit to impose, provided that such conditions are within their powers. No Government department has power to require the attendance of another man in addition to the driver, although the licensing authority might do so if they wish. A general requirement that a man in addition to the driver should be at the rear of each such vehicle would impose a heavy additional expense upon the proprietors of these vehicles.

Mr. Neal stated that there were no official figures available showing how many motor vehicles, licensed to carry more than twelve passengers besides the driver, had been registered by the proper authorities in England, Wales, Scotland, or Ireland respectively. These vehicles would be registered as heavy motor cars, without details of the seating capacity, and no reliable figures could be obtained. The maximum weight of a heavy motor car is five tons unladen, and the maximum width 7 ft. 6 in. The penalty for passing over a bridge that is properly notified as not being made safe is £10, and for passing along a road on which such vehicles are prohibited, £20. He did not consider it desirable to establish a Highways Committee as a temporary adjunct to the Road Board to inquire into the abnormally high road rates imposed on ratepayers throughout the country. Under the new taxation proposals all mechanically propelled road vehicles would be directly taxed towards the maintenance and improvement of roads.

Sir Eric Geddes had previously said that the whole question of the regulation of motor chars-a-bancs was now being considered by the Departmental Committee on the Regulation of Road Vehicles, who will make recommendations as to the action which they consider should be taken to bring the existing provisions as to licensing, etc., in accord with modern requirements. He anticipated that if the committee's recommendations were to be carried into effect, legislation would be necessary.

THREE-COUNTY OMNIBUS SCHEME.

JOINT COMMITTEE FOR INTER-RUNNING.

The Parliamentary Committee of the Middlesex County Council on June 24 reported to the Council on the proposal to establish a joint control by the Middlesex and Hertfordshire County Councils of any omnibus services which may be provided within the Greater London area. The County Council had already agreed in principle to the proposed joint control of the omnibus undertakings, but dissented from the provisions of the Hertfordshire County Council Bill, under which the Minister of Transport might make an order setting up a joint committee. It was considered undesirable by the Parliamentary Committee that the Minister should be vested with such power except by consent of the County Councils concerned. It had since been agreed that the Middlesex and Hertfordshire undertakings should be run under the sole management and control of representatives of the two counties on a joint committee, together with the London County Council, which had agreed that their powers to run into the areas controlled by such joint committee should be exercised through and by the latter body, and, further, that their powers on the joint committee should be limited to omnibus routes running from London. The setting up of the joint committee was vital to success, and it was hoped to secure the support of the Minister of Transport.

THE "K" TYPE OMNIBUS.

The Associated Equipment Company have arranged for one of their "K" type omnibuses to be on view in various provincial centres where they have representatives. At a recent view in Birmingham of this new London General Omnibus Company's vehicle it was inspected by representatives of the Birmingham, Coventry, Walsall, and Wolverhampton Corporation Tramways, and of the Birmingham and Midlands Omnibus Company. Orders for the "K" type chassis can now be accepted for passenger and industrial use, fitted either with the 30 H.P. engine or one more powerful for operation in hilly districts. The new omnibus is now a common object in London and suburbs, and in a month or two it will have replaced all the green painted vehicles whose colour tells of strenuous service in France and Flanders.

CONVERSION OF A THORNYCROFT.

The illustration below of the tower wagon in use on the Southampton Corporation Tramways shows to what good purpose an enterprising management can turn a reliable second-hand chassis in these critical times. Dealing with breakdowns by means of a

Southampton Tramways Tower Wagon.

horse wagon had proved both costly and slow. Mr. Dobson was fortunate in securing a second-hand Thornycroft chassis, and upon this reliable foundation the extending tower ladder has been built.

DRIVERS' COMFORT AND EFFICIENCY.

The Vulcan Company claim to be the originators as standard practice of the enclosed driver's cab and electric dynamo lighting, which constitute two of the greatest advances since the inception of motoring. The former provides the driver with comfortable seating and protection against bad and windy weather, dust, and flies. Coupled with the benefit of electric lighting this means that when a user purchases a Vulcan commercial vehicle he is taking care that his driver is working under the most favourable conditions, and in return he gets maximum efficiency from the driver to the extent of many extra miles per day. These special features, which were in evidence on the automatic hydraulic tipping wagon, farmers' and tradesmen's delivery wagons at the Royal Show, created a considerable interest amongst users and prospective buyers of commercial vehicles. Upwards of 2,000 of these vehicles have been delivered in the British Isles during the past few months, and the average weekly delivery exceeds 100 vehicles. Visitors to Southport who are interested in motor vehicles are always welcome to the works.

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MOTOR TRAFFIC

ROAD TRANSPORT CHEAPER THAN RAIL.

EXPERIENCE OF LIPTON'S TRANSPORT MANAGER.

In giving evidence before the Rates Advisory Committee of the Ministry of Transport on July 21, Mr. J. L. Clewes, transport manager for Lipton, Limited, stated that their experience of the railway strike last year taught his company so much that since then they had put into service 14 4-ton petrol lorries to save transport by railway. They had no contractors working for them until after the strike. Road transport to-day was beating the railways. Goods in some places out of London were on sale in the shops upon the same day that they were sent out. The railway companies had to face serious competition from road transport. His opinion was that the present rates should be left alone, and each railway be given its freedom. This, he thought, would raise more revenue than by doubling the rates. He found he could rely on the 14 4-ton lorries to distribute 60 tons of food per day, the average run being 70 miles, or a total mileage out and home of 1,000 miles a day. During the railway strike they served their shops during that week by road as far north as Sheffield, east to Yarmouth and Ramsgate, all the south coast to Bournemouth and west to Bristol, the vehicles averaging 100 miles per day. To-day they were making regular weekly deliveries by road to places 100 miles from London. In fact the previous week they sent goods to Leeds—nearly 200 miles—by road. The cost was cheaper than transport by rail, and if there should be a fall per gallon in the price of petrol the transport cost would further decrease. Unless the railways kept down their rates, and got back to something like the old-time efficiency of 20 years ago, they were bound to suffer very seriously through the keen mobile competition of the road carrier.

ROADS AND MOTOR TRAFFIC.

Sir H. Maybury, director of the roads department of the Ministry of Transport, speaking at a conference of the Commercial Motor Users' Association at Blackpool on June 5, stated that the Minister of Transport realised what a great part motor transport, and particularly the heavy side, played in the welfare of the community, and it was his desire to remove the vexatious restrictions and regulations so far as was consistent with the safety and welfare of the public. He hoped to see a large increase in motor transport. Some 40,000 motor vehicles used on the western front had been distributed into industry, and it was estimated that by the end of the present month there would be 750,000 mechanically propelled vehcles of all kinds on the roads of Great Britain. He hoped to see a very large increase even beyond that figure. The previous week he met a representative of the American Government to discuss the road transport question, and he ascertained there were in America over six million motor vehicles. The proportion of motor vehicles in America was one to sixteen of the population; in Great Britain it would be one to 120. He thought at no distant date we should have in this country one motor vehicle for every ten or twelve of the population, and he hoped to see the roads good enough.

Referring to the plea in certain quarters that the Ministry should run motor services, Sir Henry said they had decided that under no circumstances would they instal such services until private enterprise had been exhausted.

Adverting to road reconstruction, he stated that the cost of road maintenance had gone up 131 per cent. since 1914. Unless owners of motor vehicles agreed to pay the new taxes proposed in the Finance Bill it was impossible to have the roads for their vehicles. "We have 94,000 miles of roads in the country in the hands of rural district councils," he continued. "These councils are badly hit. Their resources are limited. They are unable to pay adequate remuneration for officials they ought to have. In one district a penny rate produces £34, and £30,000 is required for roads. How is it possible for them to pay? What can they do? One answer is that roads should be vested in the County Council. In many cases I persuaded County Councils to find a large part of the money."

The speaker went on to point out that other road authorities, like the tramway authorities, were also in an awkward position Under statutory obligation, the tramway people had to maintain their track and 18 inches on each side, but when that provision was first made heavy motor traffic was not in existence. Out of the money the Ministry of Transport was proposing to raise by taxation they proposed to devote 1½ million the first year to improving and widening old roads and laying out new ones. It was not possible at present for the local authorities to do much.

STRAIGHT TALK IN THE U.S.A.

Writing in the *Electric Railway Journal*, "An Engineer" of a large electric railway system says—"Are we not doing exactly that which in other lines of business would be certain suicide? Consider our attitude toward the jitney. Granted that it is an outrageous—indeed a criminal—competition. What do we do? We damn the jitney and demand its immediate suppression, thereby creating a feeling that we are picking on a little fellow, when a plea that it be called upon to share the paving and similar trolley burdens would get at least as much attention and if granted would be just as effective a stop as an ordinance to that effect. And when the public does not suppress the 'jit,' instead of making our service so attractive that we starve the other fellow out, we instead endeavour to bulldoze the public into riding with us by cutting down the service and making it less desirable!

"I believe we have got to start fresh, shutting down a very considerable mileage, not with loud words of defiance, but in considerable humility and a frank admission—and one that will stand investigation without blowing up—that we haven't the money with which to run in competition, and that, too, without mud slinging at a competitor which, however much we may damn it, and—on paper—prove its unprofitableness, still remains a mighty unpleasant absorber of revenues we need the worst way.

"Moreover, we have got to forget many of the 'principles' of operation we have been following, we have got to make schedules to meet the convenience and wishes of the public, and we have got to make our service so attractive that the public will come to us for the same reason it goes to certain of our merchants in preference to others. That our competitors are not playing fair, that the public is not playing fair, is all beside the question. These are actual conditions we are up against. We must meet them and overcome them, or bust."

HAULAGE OF BUILDING MATERIALS.

PERTH (W.A.) TO FOLLOW DURBAN'S EXAMPLE.

In his annual report the Perth (Australia) city engineer makes a suggestion in regard to the use of the tramways for haulage purposes. The question of the ever-increasing cost of haulage has occupied his attention, and he suggests that the Government be approached with regard to utilising the electric tramway system for the conveyance of building materials to all parts of the metropolis. By this means the present inflated cost of building material could be considerably reduced. The city engineer adds—"The tramway rail gauge is similar to that of the State system, and it would be a simple task to fit up many trolley cars to carry bricks from the kilns to the dumping yards placed half-way, and at the ends of the suburban routes. Hundreds of thousand of tons could be handled annually in this manner between the hours of 12 p.m. and 6 a.m. Durban Corporation convey all their own road materials in this manner during daylight, without the slightest interruption of passenger traffic."

REGULATION OF COACH TRAFFIC.

Motor coaches visiting Blackpool from the Midlands and the North have become so numerous that the police have issued the following regulations with a view to preventing obstruction—

All drivers of chars-a-bancs entering the borough shall, after unloading, drive off immediately to a garage.

No chars-a-bancs to be permitted to remain in any street longer than necessary for the expeditious unloading of passengers or to cause an obstruction in such street.

The proprietor, driver, or other person in charge of chars-a-bancs to load, or cause the chars-a-bancs to be loaded, at a garage and not in a street.

The Whitegate Park trotting track and premises in Rigby Road have been opened as garages.

THE PALLADIUM CHASSIS.—In our issue of July 15, by a clerical error a plan of a Palladium chassis was described as the Wallace type. The drawing was, however, that of a chassis supplied by the Palladium Autocars, Limited, for the motor coaches of the Great Grimsby Street Tramways Company. The Palladium chassis of the same type is also used by the Grimsby Company for its omnibuses, of which illustrations appear on page 110 of this issue.

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MOTOR TRAFFIC

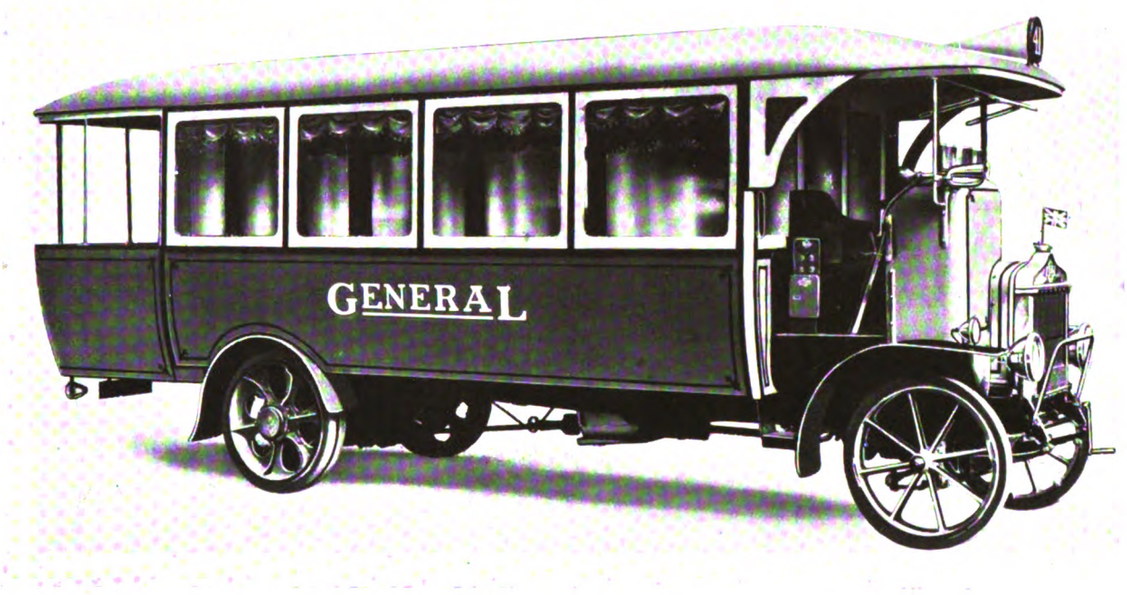
A LONDON OMNIBUS AT ANTWERP.

The London motor omnibus service has long been held up to continental city engineers as a model of what a public transport service should be. Many of these engineers have had opportunities of studying the system in London itself, but those to whom such opportunities have been denied have recently had a chance to inspect a specimen chassis and omnibus, and to talk over the subject thoroughly at the Antwerp Exhibition, which closed on July 25. There the Associated Equipment Company, the builders and designers of the London General motor omnibuses, have exhibited in the commercial vehicle section.

With a view to fostering continental trade, the Associated Equipment Company sent over to Antwerp expert engineers, who met their confrères and interested members of public bodies or private companies in discussion, and gave advice, taking each individual case on its merits.

At the exhibition there was a single-deck omnibus capable of seating 25 adult passengers, with room on the rear platform for 12 additional passengers standing.

This omnibus, illustrated on this page, is mounted on an A.E.C. "K" type chassis, which is specially designed as an economical and efficient vehicle for passenger or goods transport work. The arrangement of the driver's position at the side of, instead of behind, the engine, increases the length of loading platform by 3 ft. 6 in. without adding to the overall length of the chassis. The design also allows a more even distribution of load on the axles, and reduces the body overhang behind the rear axle. This feature, in conjunction with the specially designed springs, provides an exceptionally comfortable ridiug vehicle. The height of the top of frame from the ground level is only 2 ft. 5 in., this being an unusually low figure for a chassis of this category. Used as a apssenger vehicle the chassis will carry a load of 3½ tons on the frame, this including body. If used for goods transport, the guarantee covers loads up to 3 tons, including body. The weight of the chassis is unusually light, being only 2 tons 6 cwt.



An Omnibus Built by the A. E. Co., Exhibited at Antwerp.

A Sign of the Times.—Horse-cab and taxi-cab drivers in Edinburgh went in a deputation to the Corporation Tramways Committee recently pointing out that the motor coach tours inaugurated by the Corporation this season had considerably reduced their takings from hirings. Visitors who had formerly gone sight-seeing in and around the city in cabs and taxis were now patronising the Corporation's motor chars-a-bancs. The Committee resolved to take no action.

TRACTION CHOICE IN THE UNITED STATES.

Mr. J. H. Pardee, president of the American Electric Railway Association, in an article contributed to the *Electric Railway Journal*, says—"I have no fear that the motor vehicle will intrude itself into the situation to an extent that will imperil the usefulness of electric transportation upon tracks. In this connection two recent occurrences stand out in bold relief. It is of the greatest significance that Mayor Couzens of Detroit, himself an automobile man, whose long term as general manager of the Ford Motor Company gave him a knowledge of the possibilities of the internal combustion engine and who has had wide experience with the extended use of the cheapest and most adaptable car on the market, totally and utterly rejected the motor omnibus as a means of providing transportation, although every interest dictated that he should adopt the best and cheapest method in his attempt to compete with the Detroit United Railway. Of equal significance is the fact that Henry Ford himself, while advocating a self-contained vehicle propelled by a gasoline engine for interurban use, clung to rails and refused to entrust his new device to rubber tires.

"Nowhere in the United States is the motor vehicle giving a complete system of local transportation in any but the very small communities. Faced with the choice between street railways and the jitney, the Massachusetts cities served by the Eastern Massachusetts Street Railway have decided in favour of the former.

"Those cities in which unrestricted jitney competition is now permitted must, in my opinion, soon make a similar choice. I do not believe that the electric railway can hamper the development of the motor vehicle. I do not believe that it should do so if it could. I do believe, however, that the motor vehicle has no greater rights than the electric car, and that it should not be permitted to interfere with electric railway development."

The Vulcan Motor and Engineering Company (1906), Ltd., Southport, during the week ending July 10 passed the 2,000 figure for total post-war output of Vulcan chassis, and during the past six weeks 600 chassis were produced. In order to assist the user, this firm make a practice of delivering at least half the output as complete vehicles. This includes tradesmen's and farmers' general purpose lorries, tipping wagons, 16-20 seater omnibuses and chars-a-bancs The colonial and foreign market is well provided for, and up to 50 per cent. of the output is now available for British overseas trade. This company, with their average output now exceeding 100 commercial vehicles per week, claim to be the largest manufacturers of those vehicles in the British Isles.

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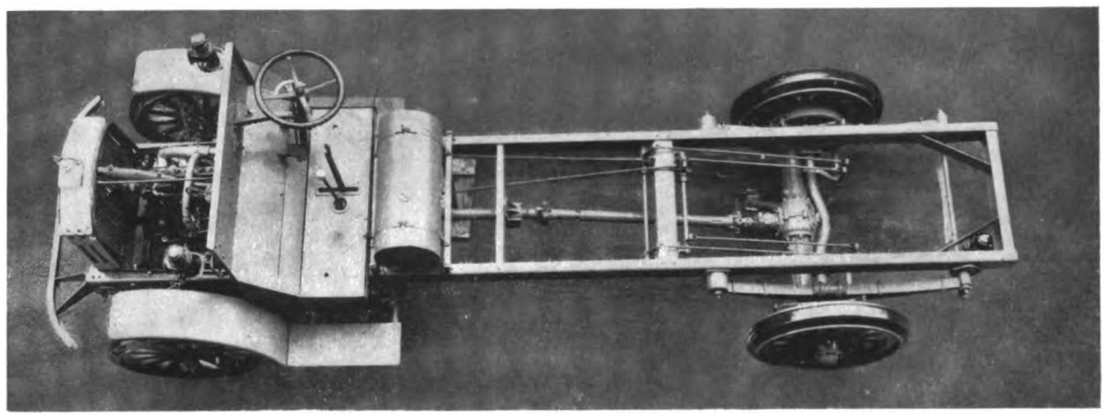
MOTOR TRAFFIC

THE WALLACE LORRY.

To the specification of the Wallace 30 cwt. lorry published in our issue of July 15 it may be added that the Richmond Motor Lorries, Limited, of 222, Great Portland Street, W.1, do not intend permanently to build their vehicles with component parts from the United States. It is intended as soon as practicable to construct the whole vehicle from materials produced in Great Britain, but meanwhile provision has been made for placing 2,000 vehicles annually on the British market. By the time arrangements are completed for home production it is anticipated that the demand will exceed the supply. For a complete chassis selling at £675 the demand is likely to be widespread when its merits become known. Having had wide experience of the work of the leading motor manufacturers in this country, Mr. Wallace on deciding to supply the want for a 30 cwt. machine, asked for offers from British firms. As they were too busy to undertake the work, he had no option but to put to practical use his knowledge of the economical production to be obtained from a number of American firms. Below is reproduced a photograph giving a comprehensive view of the Wallace machine.



Wallace 30-cwt. Chassis with 25-h.p. 4-Cylinder Continental Engine.

L.G.O.C. MOTOR COACH TOURS.

By Chars-a-bancs Through the Home Counties.

The London General Omnibus Company are to be congratulated on the series of conducted char-a-bancs tours which they are now running to certain beauty spots in the Home Counties. Although only recently inaugurated, these tours are the realisation of a project formed so long ago as June, 1914—arrangements cancelled by the war. Three separate tours—Hindhead, Windsor, and Tunbridge Wells—are now in operation on Mondays, Wednesdays, and Thursdays respectively.

A medium size, smooth-running char-a-banc of the well-known A.E.C. type is used, with accommodation for 27 passengers. Each tour is under the supervision of an official of the company, who points out the chief features of topographical and historical interest, so that the tours have an educational as well as a recreative value.

The initial run to Hindhead and back on Monday was through the pine woods and over the wild heather-clad commons for which the Surrey hills are famous. The route was by way of Putney Heath, Kingston and Ripley to Guildford, where luncheon was taken, then through Godalming and Milford, and across Witley Common to the Devil's Punch Bowl at Hindhead, where a halt enabled the passengers to view the wonderful panorama seen from the crest of the hill. The return along the ridge of the North Downs only touches occasionally—such as the call at Guildford for tea—the towns and villages passed through on the outward trip.

The Tunbridge Wells and Windsor tours are equally delightful. For each tour a charge of one guniea is made, this including luncheon and tea. The chars-a-bancs leave 31, Broadway, St. James's Park Station, at 10 a.m., and arrive back in town between 6 and 7 p.m. Seats can be booked in advance at the season ticket office, Mansion House Station; Passenger Agent's office, Oxford Circus Station (C.L.R.); Private Hire Department, L.G.O.C., 31, Broadway, Westminster, S.W.1.

IMPERIAL TRANSPORT CONFERENCE.

Important problems and considerations connected with the development of roads and of road transport, and with the creation and distribution of motor fuel supplies within the Empire will be discussed at a conference in course of organisation by the Imperial Motor Transport Council. It will be held in London on October 18 to 21, at which time the first post-war exhibition of commercial motor vehicles will be in progress at Olympia. The Council responsible for the organisation of the conference has as its president, Prince Arthur of Connaught, while the Hon. Sir Arthur Stanley is chairman of its executive.

The conference will be divided into two classes, the one dealing with roads and transport and the other with fuels. The former will be organised as regards details by the Empire Roads and Transport Committee of the Council, constituted as follows—Mr. H. C. B. Underdown (chairman), president of the Association of British Motor Manufacturers, Limited; Mr. H. P. Boulnois, chairman of the Roads Improvement Association; Mr. J. S. Brown, Union of South Africa; Mr. B. Caillard; Mr. F. Coates, Commonwealth of Australia; Sir J. Duncan Elliott, Dominion of New Zealand; Mr. W. Eraut, Crown Colonies; Mr. L. Griffith, Dominion of Canada; Mr. V. Gordon, Dominion of Newfoundland; Mr. C. E. House, Department of Overseas Trade; Lt.-Col. T. M. Hutchinson, War Office; Sir Henry P. Maybury, Ministry of Transport; Lt.-Col. W. Paisley Robinson, Mechanical Transport Adviser to the Government of India; Mr. E. S. Shrapnell-Smith, and Mr. H. Wyatt. The general object of the discussions in this section will be to encourage uniformity of policy in respect of roads and transport throughout the Empire. Thus, for example, consideration will be given to the desirability of securing general approval by the Governments of the Empire of the principle that the proceeds of motor taxation should be allocated specifically to the roads. Another important matter is the provision in all parts of the Empire of a sufficiency of vehicles suitable for military use in emergency and so constructed as to form efficient and adequately standardised fleets in the event of collaboration of the forces from the various parts of the Empire becoming necessary.

The Roads and Transport Section of the conference will be presided over by the Rt. Hon. Sir E. Geddes, Minister of Transport. The Rt. Hon. W. Long, First Lord of the Admiralty will act as chairman of the Fuels Section. This will deal with various aspects of the fuel problem and the possibilities of its solution by the creation of new and the development of existing sources of supply. The detail organisation will be in the hands of the Empire Motor Fuels Committee of the Council.

Invitations to be represented at the conference have been addressed to the Overseas Governments of the Empire, including the Dominion Governments and the various state and provincial Governments and appropriate Government Departments in every instance. Invitations have also been sent to the Crown Colonies and to leading municipalities, chambers of commerce, agricultural associations, trade associations and automobile clubs in all parts of the Empire. Communications from readers who may desire facilities for attending or may wish to put forward suggestions of subjects for discussion should be addressed to Mr. H. Wyatt, Hon. secretary, Imperial Motor Transport Council, Royal Automobile Club, Pall Mall, S.W.1.

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MOTOR TRAFFIC

MOTOR VEHICLES FOR MUNICIPALITIES.

CHATHAM COUNCIL have ordered a lorry.

WARRINGTON CORPORATION are obtaining a lorry.

HASLINGDEN COUNCIL are obtaining a tipping wagon.

WALLASEY COUNCIL are purchasing two electric vehicles.

RUGBY CORPORATION are purchasing a motor fire engine.

CALCUTTA COUNCIL have decided to purchase a Dennis lorry.

GLASTONBURY COUNCIL have placed an order for a steam wagon.

DRONFIELD URBAN COUNCIL propose to purchase a motor fire engine.

TODMORDEN CORPORATION propose to increase their fleet of omnibuses.

WORKSOP URBAN COUNCIL are obtaining a motor wagon for refuse collection.

BEXLEY URBAN COUNCIL are obtaining a loan of £1,338 for the purchase of a steam wagon.

HULL CORPORATION are erecting a garage for their motor vehicles and fitting it with machine tools.

KING'S LYNN COUNCIL have received sanction to a loan of £2,750 for the purchase of motor vehicles.

ENFIELD URBAN COUNCIL are borrowing £1,400 for the purchase of an electric vehicle for refuse collection.

COULSDON AND PURLEY URBAN COUNCIL are raising a loan of £1,323 for the purchase of a steam wagon.

TORQUAY TOWN COUNCIL have secured sanction for a loan of £1,900 for the purchase of a motor fire engine.

BRISTOL CORPORATION have obtained permission to borrow £18,580 for the purchase of motor fire appliances.

PLYMOUTH CORPORATION have accepted the tender of Mr. W. Mumford to supply two 2-ton lorries at £900 each.

MANSFIELD CORPORATION have purchased two electric tipping wagons at £1,820 each and two petrol lorries at £1,800 each.

DEPTFORD WORKS COMMITTEE have recommended the purchase of a Straker-Squire vacuum gully emptying machine, at £1,350.

GRIMSBY HIGHWAYS COMMITTEE recommend the purchase of six electric 2-ton vehicles for scavenging and highway purposes, at £9,500.

LIVERPOOL CORPORATION are recommended by their committees to purchase from local firms motor vehicles for the veterinary, health, and surveyor's departments.

SOUTHEND LIGHT RAILWAYS COMMITTEE have recommended the purchase of an electric 3-4 ton wagon, at £975, from the Lincolnshire Motor Traction Company, Grimsby.

DURHAM COUNTY COUNCIL have been recommended to authorise the county surveyor to purchase a petrol locomotive as early as possible at a price not exceeding £500.

PLYMOUTH CORPORATION WORKS COMMITTEE have accepted the tender from Straker-Squire, Limited, for a motor vacuum gully cleaner at £1,350, and of Thornycroft and Company for two tipping wagons at £3,159.

THE LANCASHIRE AND YORKSHIRE RAILWAY COMPANY has placed a repeat order for twelve 3-ton Albion chassis. This makes a total of 27 Albions supplied to the Lancashire and Yorkshire Railway Company since the armistice.

BRADFORD TRAMWAYS COMMITTEE have authorised the chairman, deputy chairman, and general manager to purchase a chassis for a lorry for the parcels department. The Streets Committee have agreed to purchase a 1-ton vehicle.

BATH CORPORATION have been advised by the Surveying Committee to allow the surveyor to purchase a car for his own use and to grant him £400 a year for its running and maintenance. A second motor fire engine is to be obtained.

HERTFORDSHIRE COUNTY COUNCIL are obtaining two cars for the use of superintendents of the police force, thus reducing the horse establishment by two horses. Besides effecting economy, the cars are expected to conduce to greater efficiency.

MANCHESTER HEALTH COMMITTEE have accepted the tender of Messrs. Clayton and Shuttleworth, Limited, for the supply of a Clayton electric wagon at a cost of £1,350. The Paving Committee have agreed to purchase three petrol lorries to cost £3,500.

BETHNAL GREEN COUNCIL have agreed to John I. Thornycroft and Company advancing the price of each of three vehicles ordered from £1,278 to £1,520, on account of heavy increases in wages and cost of materials since the order was placed. Before agreeing to this course the Council obtained quotations from 11 leading firms, when the increased price asked was found still the most advantageous.

MOTOR TRAFFIC NOTES.

FARES AT PLYMOUTH.—The Tramways Committee have fixed the fares on the omnibuses at 1d. per mile, with a minimum fare of 2d.

LICHFIELD TO STAFFORD.—On July 17 the Birmingham and Midland Omnibus Company inaugurated a service between Lichfield and Stafford.

LONDON MOTOR STATISTICS.—During the March quarter the London County Council registered 5,845 light motor cars, 1,137 heavy cars, and 5,106 motor cycles, whilst 26,853 driving licences were issued or renewed.

LEVY ON CORPORATION OMNIBUSES.—The Watch Committee of Plymouth Corporation have consented to the routes of the new Corporation omnibus services on condition that the Tramways Committee pay 1½d. per omnibus mile.

OMNIBUSES FOR LINCOLN TRAMWAYS.—At a meeting of Lincoln Corporation on July 27, approval was given to the Tramway Committee's plans for the provision of motor omnibuses, and it was resolved to apply to the Ministry of Transport for sanction to borrow £27,000 for that purpose.

MIRRORS FOR MOTOR VEHICLES.—The County Councils Association have asked the Ministry of Transport to institute a regulation requiring heavy mechanical vehicles to be fitted with a mirror on the offside, for the purpose of enabling drivers to observe traffic approaching from the rear.

OBJECTION TO METAL TIRES.—The Ministry of Transport promise to consider the suggestion of Camberwell Borough Council that metal shod motor lorries should be prohibited. The question is being brought before the Departmental Committee on Taxation and Regulation of Road Vehicles.

ABERDEEN'S NEW MOTORS.—The Aberdeen Suburban Tramways Company have decided to develop their motor services and have placed an order for six Leyland chars-a-bancs, each between 30 and 40 H.P. and capable of accommodating 38 passengers. The first of the new vehicles has been delivered.

THE RULE OF THE FOOTPATH.—On July 13 the London County Council adopted a resolution to the effect that a "left-hand" rule of the road is preferable to the existing custom of keeping to the right-hand side of the path, inasmuch as its observance should minimise the number of street accidents to pedestrians.

SUGGESTED OMNIBUS SERVICES AT BURNLEY.—The annual report of Mr. H. Mozley, general manager of Burnley Corporation Tramways, contains an announcement that in view of the increased cost of installing tramways it has been decided to consider the use of motor omnibuses. A sub-committee is preparing a report.

OMINBUS SEAT COVERS.—Camberwell Borough Council have called the attention of the Ministry of Transport to the inconvenience suffered by the public owing to seat covers not being provided for the outside of omnibuses. The Council have asked the Ministry to make a regulation to enforce the provision of such covers.

GREAT AUTOMOBILE AND ENGINEERING FUSION.—The Darracq-Sunbeam group has now acquired W. and G. Du Cros, Limited, manufacturers of the W. and G. commercial vehicles at Acton, Clement-Talbot Company, Heenan and Froude of Worcester and Manchester, and Jonas Woodhead and Sons, engineers, of Leeds.

UNSUITABLE ROADS FOR OMNIBUSES.—Reporting on the question of inaugurating an omnibus service between Garston and Woolton, the general manager of the Liverpool Corporation Tramways advises against the project. In view of the expenditure required on the macadam roads, he does not think that the service would be a financial success.

WATERLOO-LIVERPOOL STREET SERVICE.—With a view to relieving congestion on the Waterloo and City tube and to assist the main line railway in its heavy task during the rush hours (morning and evening) on working days, the London General Omnibus Company have increased the number of vehicles on Route 70, between Waterloo and the City.

OMNIBUS SCHEME FOR NELSON (N.Z.).—After considering the respective merits of tramways and omnibuses, a committee of Nelson Town Council have decided in favour of establishing an omnibus service. If the proposal is adopted a poll will be taken with a view to obtaining sanction for the raising of a loan for the purchase of the vehicles.

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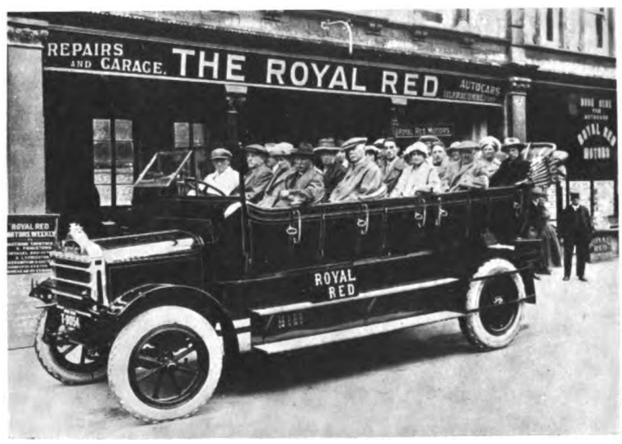
MOTOR TRAFFIC

GOVERNMENT VEHICLES ALL DISPOSED OF.—When asked recently in the House of Commons how many Government depots with accumulated lorry and car stocks remained, the Parliamentary Secretary to the Ministry of Munitions stated that the whole of the surplus stocks of mechanical transport and spare parts were sold on April 7 last, and were in course of delivery to the purchasers.

TWOPENCE PER MILE FOR ROAD MAINTENANCE.—Replying to the appeal of the United Automobile Services, Limited, against the payment of 2d. per omnibus mile to the rural authorities of the Darlington, Auckland, and Shildon districts, the Ministry of Transport have stated that the charge is a reasonable one. When the new taxation scheme becomes law the question will be reviewed.

CHARS-A-BANCS IN COUNTRY LANES.—At the annual conference of the Rural District Councils Association on July 6, Mr. C. J. Cocks, of Rochford, Essex, asked the conference to support the resolution of his council protesting against the running of chars-a-bancs on roads less than 16 ft. wide. In his district fifty of these vehicles run out of Southend daily into the narrow lanes in which no other vehicle can pass them.

A "ROYAL RED" DAIMLER COACH.—The latest addition to the fleet of Daimler chars-a-bancs run by Autocars, Ilfracombe, Limited, proprietors of the well-known "Royal Red" touring service is illustrated below. Referring to the Giant pneumatic tires, with which this vehicle is fitted, the owners say—"The increased riding



A Daimler Coach Fitted with Pneumatic Tires.

comfort obtained by the use of Giant pneumatic tires is receiving the well merited praise of our passengers. The effect on running costs and general wear and tear will make an interesting study by comparison with the rest of our fleet fitted with solids."

DRIVERS AND TRAMCAR PASSENGERS.—The Watch Committee of Hull recently suggested that drivers of road vehicles should be warned to stop whilst persons are entering or leaving tramway-cars. The chief constable, after consultation with the town clerk, has reported against the proposal and in favour of taking proceedings against any driver who may act in a dangerous manner. This suggestion has been agreed to.

EXAMINATION OF DRIVERS.—Replying to a question in the House of Commons, the Minister of Transport stated that outside of the metropolitan area, he was not aware of any expert examination and test of drivers of heavy public service and utility vehicles. Obvious difficulties would be entailed by a requirement that drivers of all motor vehicles should be tested, but he was awaiting a report on this and other subjects by a Departmental Committee.

A CONCESSION TO COACH OWNERS.—At the instance of the Commercial Motor Users' Association, an amendment was introduced into the Finance Bill on July 6, permitting quarterly motor licences to be taken out on March 27, 1921, instead of on April 1, thus enabling coach owners to cater for the Easter traffic without having to pay an additional quarter's duty for a week's use of their vehicles. This change of date will not be necessary again until 1940.

THE ECONOMY OF PETROL IN BULK.—Camberwell Board of Guardians have accepted offer of the Anglo-American Oil Company to supply bulk storage to hold not less than 500 gallons underground, together with a measuring pump. Supplied in bulk the petrol costs 1½d. per gallon less, and the Works Committee estimate that another 1½d. per gallon can be reckoned as saved from wastage. Assuming 200 gallons a month are used, the saving in petrol alone would be about £30.

DUNLOP COMPANY AND PNEUMATIC TIRES FOR LORRIES.—The experiments which the Dunlop Rubber Company entered upon before the war in the use of pneumatic tires on heavy vehicles are likely in a few months to result in such tires becoming available for public use. In addition to the company's own tests, trials have been made by the London General Omnibus Company. The results in both cases confirm American experience, namely, that a specially designed chassis is necessary to secure the most favourable results.

RECORD MOTOR COACH PARTY.—The Lancashire United Tramways, Limited, of Atherton, etc., supplied 56 motor coaches for the annual outing of the 1,450 employees of Wm. Walker and Sons and Driped, Limited, of Bolton. The party journeyed to Blackpool and back from 15 starting points, the start being made at various times between 7 and 9 a.m. Four routes were taken, and on arrival the vehicles were parked on the trotting ground. In no case did the journey occupy more than three hours. Between 7.15 and 8.15 all the coaches left for home.

A LINKING-UP SCHEME IN NOTTINGHAMSHIRE.—As Nottingham Corporation has not obtained the sanction of Parliament to their full scheme of tramways extensions, the Trent Motor Traction Company, Limited, has submitted to the various authorities a project for running a service of omnibuses in Nottinghamshire and Derbyshire, thus serving a number of colliery and other areas which are without adequate facilities. At the outset the scheme provides for the use of thirty vehicles. Nottingham Watch Committee have inspected and approved of a specimen omnibus.

COACHES AND ROAD MAINTENANCE.—Brighton Corporation have referred to the Watch Committee consideration of the question whether a charge can be imposed on the owners of motor coaches. Over 100 of these vehicles entered the town at a recent week-end, and a large number of others are locally licensed for pleasure traffic. The town clerk's opinion is that there is no legal difference between a char-a-bancs and an omnibus. Messrs. Tilling, Limited, who run the Brighton and Hove omnibuses, pay £4,000 a year for the privilege, besides paying the licensing fees for their vehicles.

OMNIBUSES FOR CALCUTTA.—Messrs. Walford and Company have made application to the Calcutta Municipal Council for facilities to enable them to introduce motor omnibuses to run between the city and the suburbs. The company's letter remarked that such a step would go a long way towards solving the housing question and also that of traffic congestion. It was resolved to inform the company that they would have to pay a licence fee in respect of the vehicles in accordance with the scale prescribed by the Municipal Act, that it had been the endeavour of the Corporation to maintain road surfaces as far as practicable in a condition suitable to the traffic passing over them, and that it was their intention to continue the same policy.

LONDON OMNIBUSES UNDER THE NEW TAXATION.—Opponents of the Government's proposals for the taxation of omnibuses have alleged that the London omnibuses now pay £79 per annum in petrol duty and licence duty, and that the increase under the Finance Bill to £84 only represents an advance of less than 7 per cent. It is explained by the London General Omnibus Company that the £79 relates to the average daily number working on the streets exclusive of spares, vehicles under repair, etc., while the £84 embraces all vehicles in stock. The figures therefore are not comparable. The correct figures are as follows. The present payments for omnibuses in stock average £63 per annum; the proposed payment of £84 represents an increase of 33 per cent.

VEHICLE PARADE AT BIRMINGHAM.—The first parade of commercial motor vehicles held in the Midlands took place at Birmingham on July 17, under the auspices of the Midlands Division of the Commercial Motor Users' Association, when 146 machines were shown. The prize for the champion team of vehicles was awarded to the Birmingham and Midland Transport Company for three Sentinels. The Dunlop Company secured leading place for the best team of three petrol vehicles in any one class, and the Birmingham and Midland Transport Company for the three best steam vehicles with the trio of Sentinels. This company also secured leading place for the best turned-out single vehicle, a Swiss Berna. Mr. S. K. Thornley chairman of the Division, advocated the introduction of a form of qualification or examination of drivers. Mr. Bristow, secretary of the parent association, stated that such a scheme had been adopted in London, and it was hoped to extend it to the provinces.

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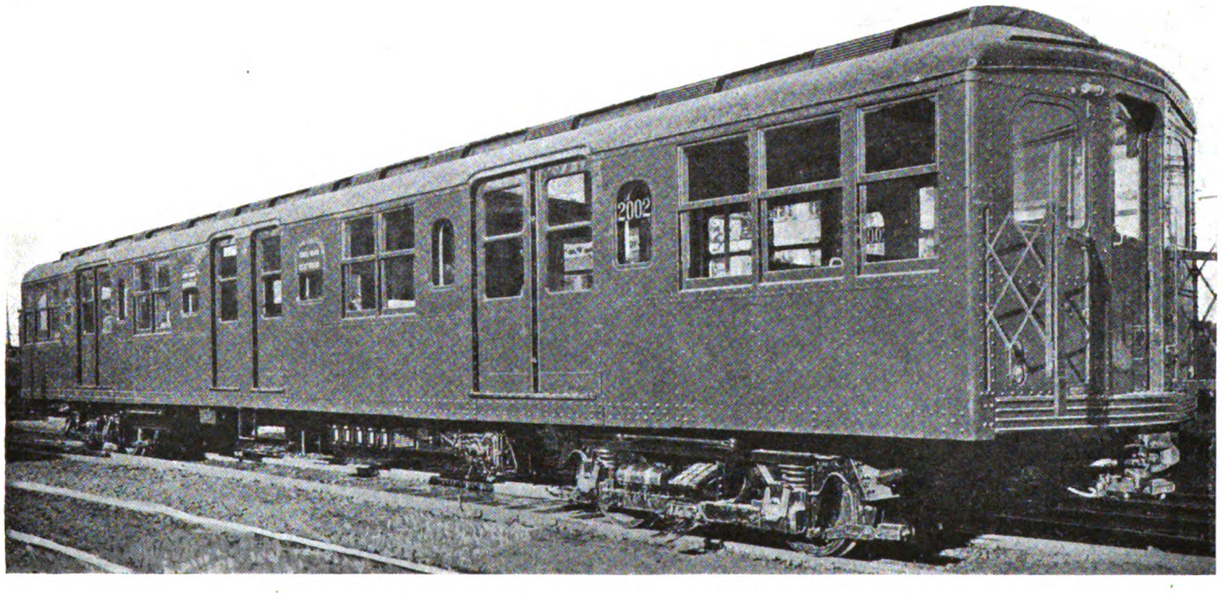
THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, SEPTEMBER 16, 1920. VOL. XLVIII.

A NEW YORK SUBURBAN ELECTRIC RAILWAY CAR.

A TYPE COMBINING LARGE CARRYING CAPACITY AND SIMPLICITY IN DESIGN AND FITTINGS.

The largest car that has yet been designed for suburban electric railway service is illustrated in the photograph reproduced below. Cars of this type have for some time been in operation in the New York subways, and it has been found a very suitable design for handling the enormous crowds of people that travel by the subway in the rush hours. This is due to the large seating capacity and the arrangement of the doors, which enable the passengers to enter and leave the car rapidly. There are fixed seats for 78 passengers, and folding seats provide for 12 more. As the latter, when in position, come down across some of the doors, thus blocking them, they are used only in the slack hours. At other times they are folded back to free all the doors and to give greater standing room, every inch of which is often in demand, for the cars at times carry nearly 400 passengers. The car is 10 ft. wide and 67 ft. long, or 17 ft. longer than the cars of the Metropolitan District Railway. As will be seen from the illustration, it has four doors on each side; two of them are double doors and two single doors, the latter being placed close together. The doors are operated electro-pneumatically. A separate push-button is provided for opening each door, but all the doors can be closed simultaneously from a single button. All the control buttons are placed on the panel between the two single doors within convenient reach of the gateman, who stands in the middle of the car. A useful feature is the collapsible gate. This comes in contact with the gate of the next car without any coupling attachment. The cars are automatically coupled, the coupling being done pneumatically and electrically by simply running the cars together. The interior of the car is very simply arranged. The seats are not upholstered, and the roof is enamelled in plain white. Near the doors are placed vertical poles, by which standing passengers may support themselves. There are also white enamelled iron hand-grips for the same purpose. While the car is excellently adapted for carrying the largest number of people possible in a vehicle of the kind, it has some features that would certainly not be popular in London. While the public have been disciplined by the stern necessities of war time to the sacrifice of much of their accustomed convenience in travel, they probably would not receive with enthusiasm a car which was designed to stereotype a condition of travel in which seats were provided for only a small proportion of passengers.



A New York Suburban Electric Railway Car—One of a Train of Ten.

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THE "EUREKA" TRACK BRAKE.

As a result of five years' experimental work, in the course of which track brakes of several designs have been installed on cars running under a variety of conditions, the "Eureka" combined track and wheel brake, which is here illustrated, has been evolved. The original object was to produce an efficient and reliable braking mechanism that would effect a saving in the cost of maintenance of tires and wheel blocks.

This was sought in an independent brake shoe acting on the track and controlled by a separate handwheel. Good results were obtained, but, as was to be expected, greater braking effect was secured by applying track and wheel brakes at the same time; for it is clearly more satisfactory to kill the rotational inertia of wheels and motor directly by a shaped wheel block than indirectly by the action of the tangential rail tread.

Accordingly in the present type of "Eureka" brake the track shoe is lowered to the rail, and the wheel blocks applied simultaneously by the use of the single brake handle. Fig. 1 shows the complete installation of the brake on a Peckham Pendulum Truck of 8 ft. 6 in. wheel base. The mechanical arrangement is shown in perspective and in plan in Figs. 2 and 3. The brake spindle on the car platform acts on the swaybar in the centre of the truck, and this turns a very strong and powerful adjusting toggle mechanism that controls the brake shoes. These have a large bearing surface, and are readily adjusted to the desired height from outside the car. The elevation (Fig. 4) shows the position of the brake blocks with respect to the wheels, and Fig. 5 displays the control mechanism.

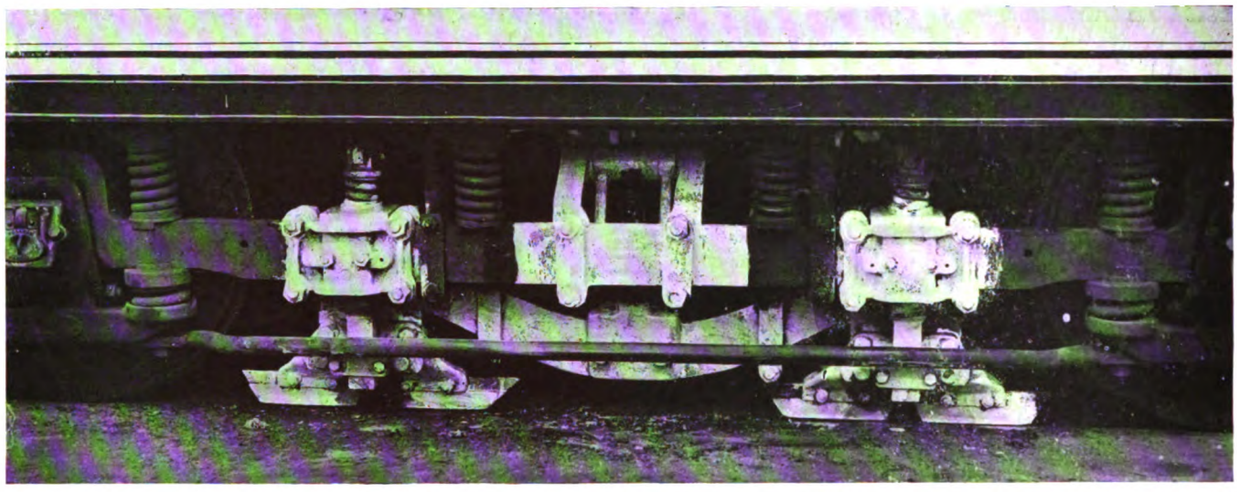

Fig. 1.—The Eureka Track Brake Installed on a Peckham Pendulum Truck.

Any car equipped with a "Eureka" brake in this way has a thoroughly efficient means of stopping under any circumstances, and would have no difficulty in passing Board of Trade tests on any combination of curves and gradients.

The usefulness of the brake does not, however, stop here. It is readily susceptible of adaptation to compressed air or electrical control, and either or both of these systems may be combined with the hand brake as described above. Where more than one system is applied to the shoe, the possibility of simultaneous failure of the controls is greatly reduced, if not entirely eliminated.

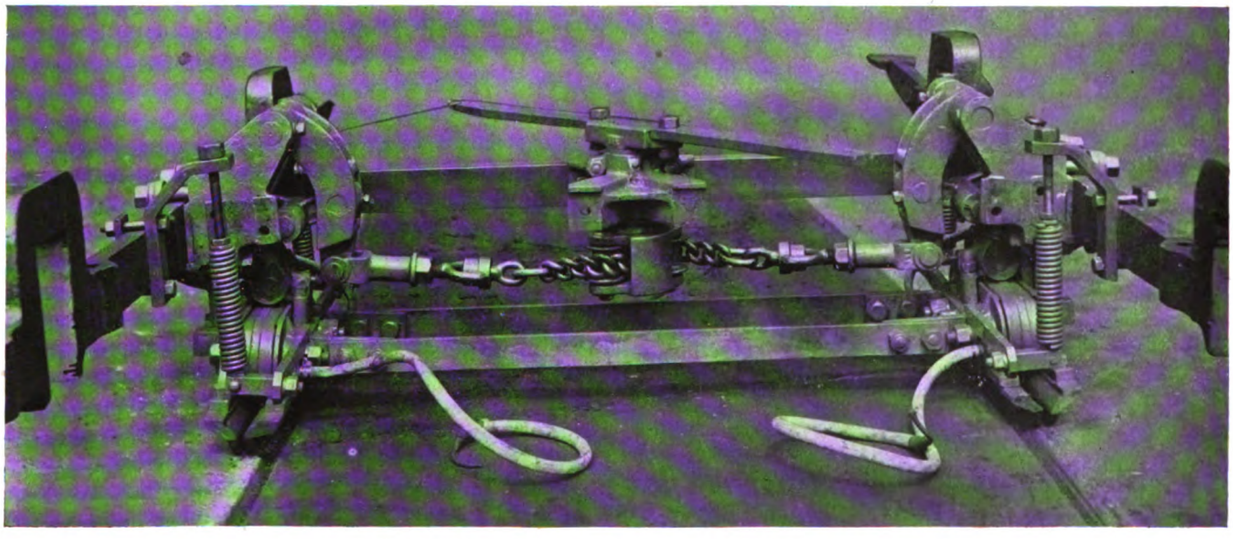

Fig. 2.—Operating Mechanism of Eureka Brake.

As a result of the installation of the electric system on a tramway undertaking with unusually sharp curves, it was found that with long wheel bases there was a tendency for the shoe to leave the rail at corners. To obviate this, double magnets have been mounted

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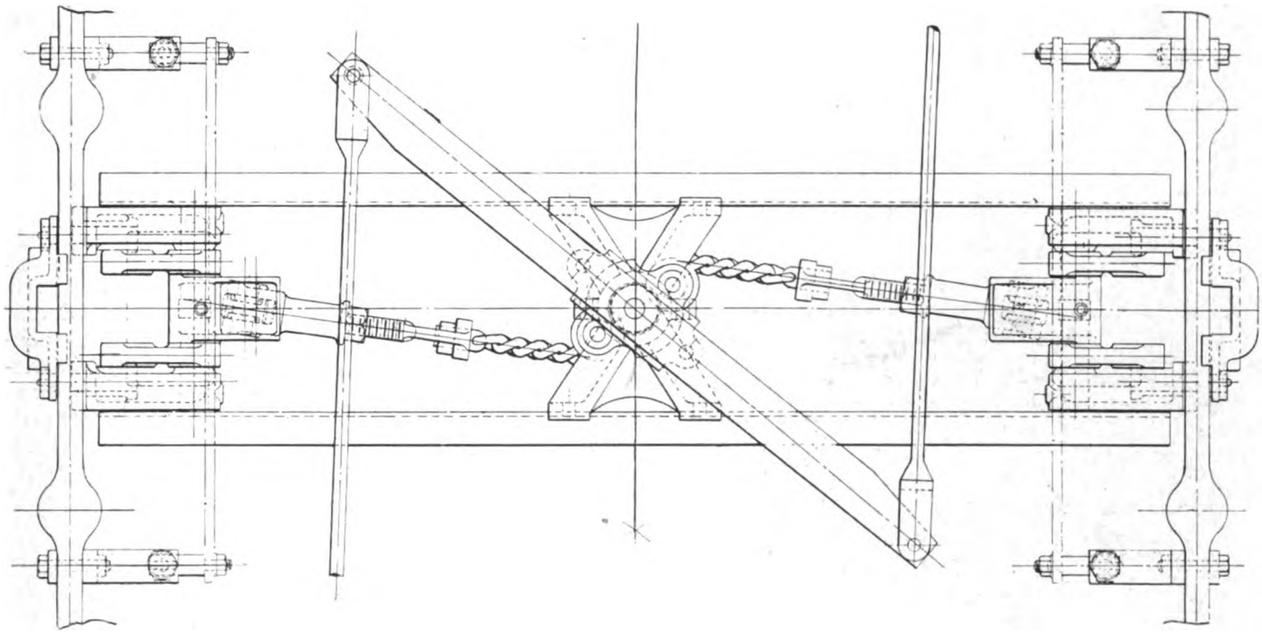

Fig. 3.—The Eureka Track Brake Shown in Plan.

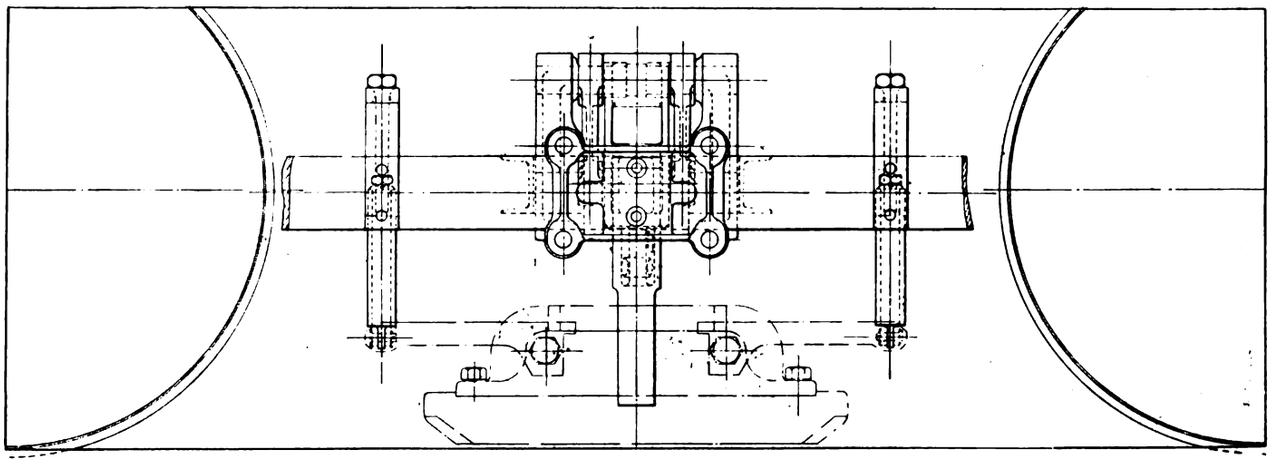

Fig. 4.—Side View, Showing Method of Attaching Brake to Side Frame of Truck.

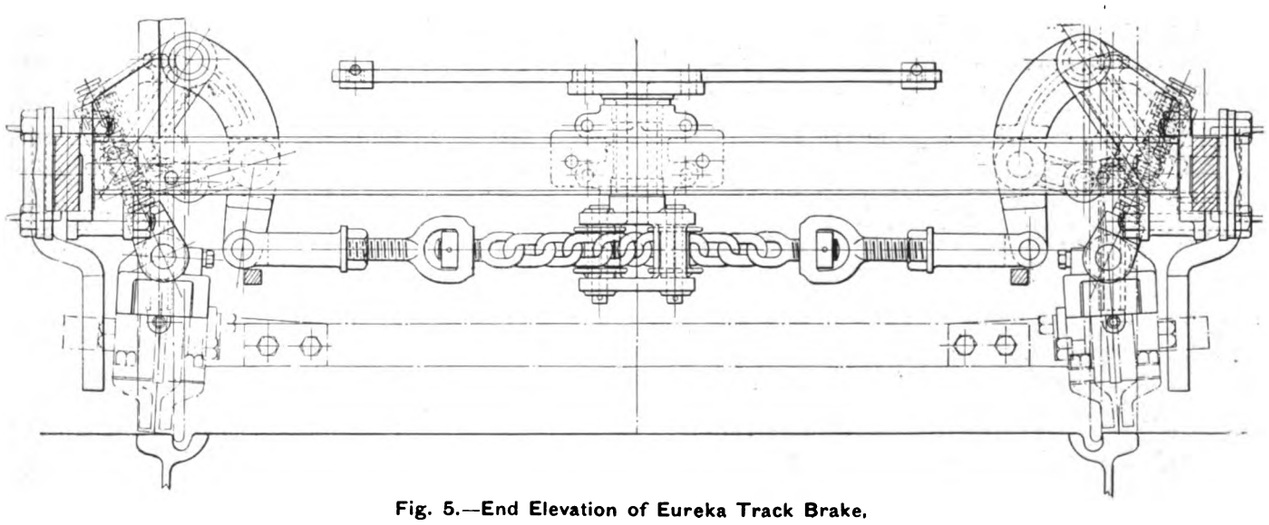

Fig. 5.—End Elevation of Eureka Track Brake.

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on the brakes fitted to all cars of long wheel base. The installation on the Peckham truck shown in Fig. 1 would be of this kind.

The system may now be regarded as having been fully tested, and it has given very satisfactory results on the undertakings that have already tried it. As its efficiency becomes more widely known, it cannot fail to receive very general application. The manufacturers are the Peckham Truck and Engineering Company, Limited, of 10, Coleman Street, London, E.C.2.

SIXTY-CENTIMETRE RAILWAYS ON THE WESTERN FRONT.

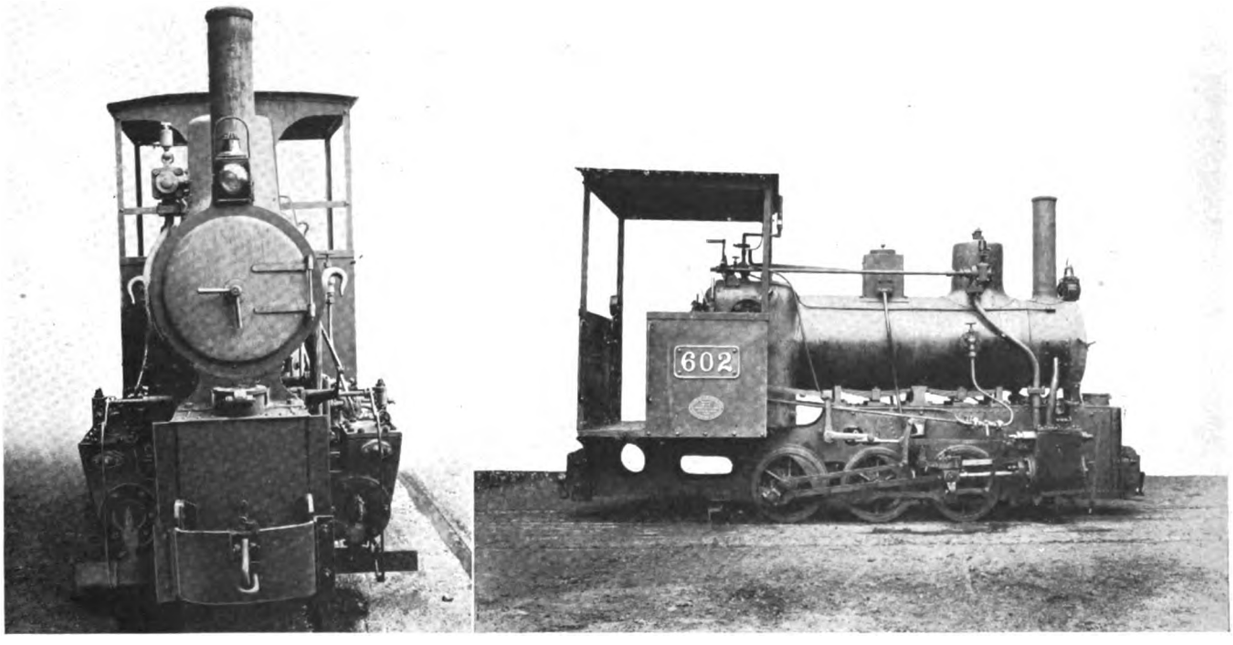
By A. L. Stead.

One of the most striking lessons of the war, from a transportation point of view, was the utility of speedily-constructed narrow gauge railway lines as a means of communication in the area lying between the standard gauge railheads and the trenches. In this important zone narrow gauge railways proved of immense service in the conveyance of *personnel* and supplies, and without their aid it is doubtful whether the work of transport immediately behind the firing-line could have been successfully carried on. The heavily shelled roads were often anything but suitable for the passage of motor vehicles, horse transport was a slow and costly business, and the standard gauge railway trains could not with safety be worked to points nearer than eight miles or thereabouts of our front-line positions.

In the early days of the campaign the difficulties attending transport in the forward area were not particularly marked, and road vehicles and main-line trains travelled in safety to within close proximity of the front. By degrees, however, as artillery activity increased, and our forces grew in numbers, the need for some other form of transport in the forward zone made itself felt, and it was to meet this need that narrow gauge railways were introduced. A few short lines of 60-centimetre railway, constructed by our French allies, were first taken over, and other lines being gradually constructed by skilled railway troops from home and overseas, there was eventually evolved a huge network of 60-centimetre railways stretching for almost the full length of the British front.

In the areas more remote from the front-line trenches the narrow gauge military lines were not dissimilar in appearance to many railways of corresponding gauge utilised for peace time purposes at home and abroad. The track was well ballasted with slag and cinders, and the rails laid securely on sleepers of wood and steel, to which they were secured by means of dog-spikes and bolts. In the area lying nearer the battle-line, however, the track was not in such good condition, and damage by shell-fire was of frequent occurrence, keeping the construction troops busily engaged in the work of repair.

The plan followed in laying the narrow gauge track was, broadly speaking, to construct a main north and south line linking up the various standard gauge lines, and from this main route to lay branches leading eastwards to within a mile or two of the trenches, with connecting lines and alternative routes at suitable intervals. Marshalling yards, exchange sidings, and loops were also provided at convenient points.



Sixty-Centimetre Steam Locomotive.

Trains were hauled over the 60-centimetre railways by both steam and petrol locomotives, all built by English makers. Steam haulage was confined to the rearward lines, and the petrol locomotives employed principally on lines in closer proximity to the front. By reason of their freedom from escaping smoke, sparks and steam, the petrol locomotives were of immense service on these forward railways, and without them it would not have been possible to work many of the railways immediately behind the firing-line.

Of the petrol locomotives employed, those used in the greatest number were of the 20 and 40 brake horse-power type, manufactured by the Motor Rail

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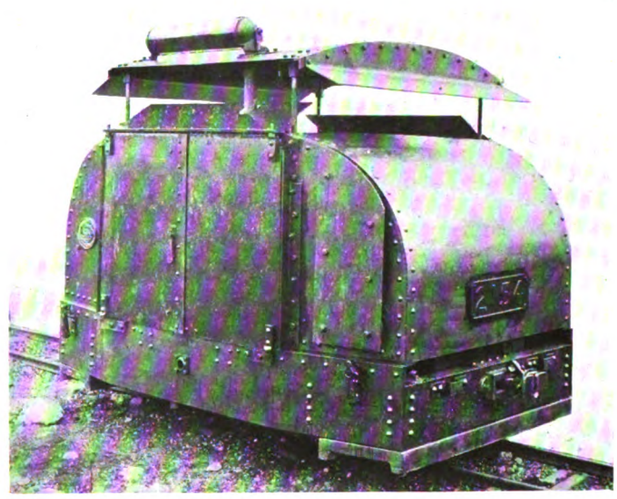
and Tramcar Company, Limited, Bedford, and whilst the 20 brake horse-power type were not usually armoured in any way, the 40 brake horse-power type were armoured to a greater or less extent by steel plates, which gave considerable protection to their drivers from enemy fire. Even on very hastily-laid track in the forward area, the petrol locomotives kept to the rails in wonderful fashion considering the conditions to be faced, although owing to damage done by hostile shell-fire derailments were at times not uncommon. Train loads up to 150 tons were obtained, and wagon loads of anything up to 8 tons.

40-b.h.p. Simplex Petrol Locomotives.

Each army had its own complement of narrow gauge railway construction and operating troops, and the lines in the army areas were usually divided into districts, each worked by a separate operating company. At the headquarters of each operating company were usually located the locomotive sheds and traffic control offices, and at intervals along the line were located in huts and dug-outs smaller control offices, in telephonic communication with the main control, whose task it was to pass trains on from point to point as expeditiously as circumstances would allow, reporting to the chief control all movements along the track. In this way supervision could constantly be maintained of traffic working, and particularly urgent loads worked forward with expedition.



40-b.h.p. Simplex Petrol Locomotive—Protected Type.

Traffic of all kinds was worked over the narrow gauge railways, but their main task was the conveyance of ammunition to the guns. Immense quantities of high explosive and gas shells were carried daily from the ammunition dumps and standard gauge railheads to the artillery positions, and loads of shell cases and empty ammunition boxes secured in the reverse direction. Guns of all calibres were also conveyed to and from the line on the specially constructed steel gun trucks utilised for this work.

In conveying troops to and from the front the narrow gauge railways performed a vast amount of useful work, and in the speedy conveyance of wounded from firing-line to hospital were entrusted with a particularly important task. Engineering material of all kinds went up the line in immense quantities by narrow gauge, and millions of tons of salved material were saved by their aid. Poison gas, rations, and a hundred and one other kinds of traffic passed over the 60-centimetre lines, and most operating companies thought little of handling a daily tonnage of from 1,000 to 2,000 tons.

The value of narrow gauge railways as a means of conveyance in the forward area was also recognised by the enemy, and on most portions of the battle front railways of this character fed the German fighting line. Curiously enough, the enemy favoured a similar gauge to our own, and full advantage was taken of this fact in our advances, the enemy track being quickly linked up by our construction troops with our own lines, and the work of transporting men and supplies to our advancing armies was thus considerably facilitated, such small damage to the track as was done by the enemy in his retreat being quickly repaired and the lines rapidly rendered fit for operation. Most of the German narrow gauge lines were in an excellent state of repair, and on many portions of the front there were long stretches of double track serving railheads, supply depots, and ammunition dumps.

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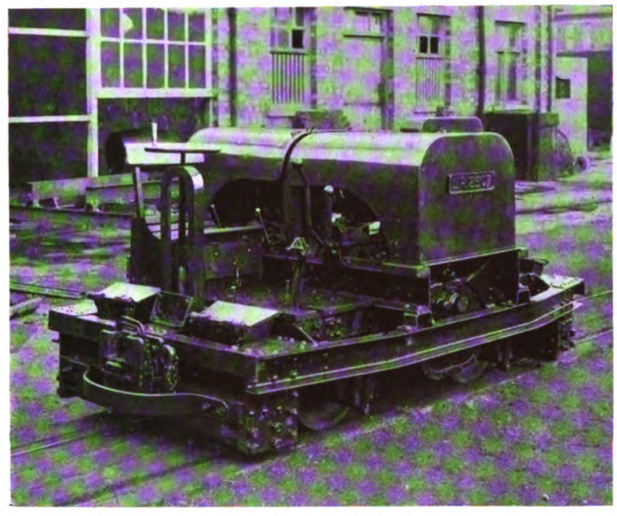
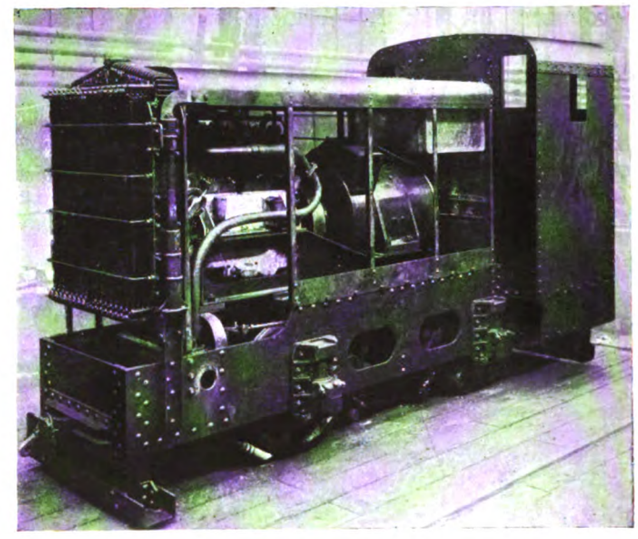
On the accompanying map of the Fifth Army narrow gauge railways, operated by our troops during the advance of 1918 which preceded the armistice, is illustrated the manner in which our own and the enemy system of 60-centimetre railways were linked up to form one complete system. First making their headquarters in August, 1918, at La Lacque, near the town of Aire-sur-la-Lys, the narrow gauge operating company serving this important portion of front established a locomotive depot and traffic control office on the standard gauge railhead at that point, and little by little built up and worked a compact system of 60-centimetre railways serving the area lying forward of La Lacque to the eastern border of the Nieppe Forest opposite Merville.



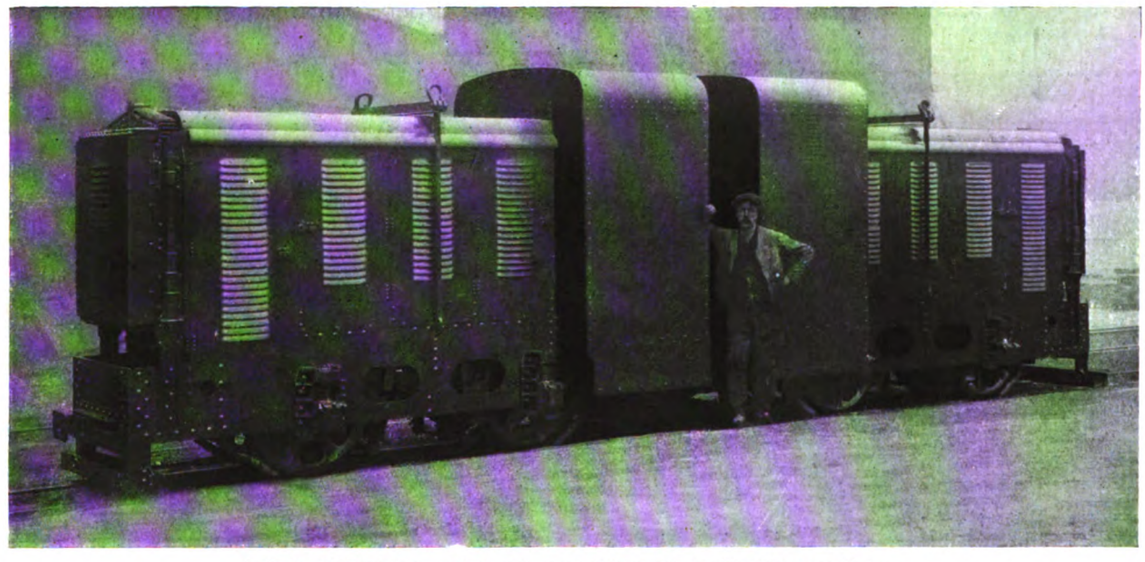
20-b.p.h. Simplex Petrol Locomotive.

Lestrem. Then came the enemy retreat which finally led to the evacuation of Lille, and the taking over by our engineers of the German narrow gauge railway system between Lestrem and Lille. How valuable an acquisition this capture proved may readily be imagined, for instead of having to lay new steel on the heels of our advancing troops, there became available an excellent narrow gauge track of which full use was at once made. On other portions of the front similar linking up of our own and enemy steel proved of equal service in maintaining touch with our victorious armies.



Dick-Kerr Petrol Locomotive Ready for Armour.

Narrow gauge railways were not only operated with success in the battle zone, but also in certain important rearward areas, more especially in the neighbourhood of Rouen. At Oissel, a few miles to the east of Rouen, a compact narrow gauge railway system brought timber from forest to standard gauge railway, where it was loaded by German prisoner labour; a similar system at Brotonne, some miles distant, conveyed timber to river craft on the Seine; Havre bakeries and petrol depots were served by a third system; and at Trouville-sur-mer hospitals and convalescent homes



A Pair of Dick-Kerr Petrol Locomotives of 60 Centimetre Gauge.

In addition to the standard gauge railhead and exchange point to narrow gauge at La Lacque an important ammunition dump at Neufpré was served, and later the station at Thiennes opened out as a railhead. Much ammunition was conveyed to the guns situated in various parts of the Nieppe Forest, and gradually as the enemy was pushed eastwards the line was extended through St. Venant and Calonne towards

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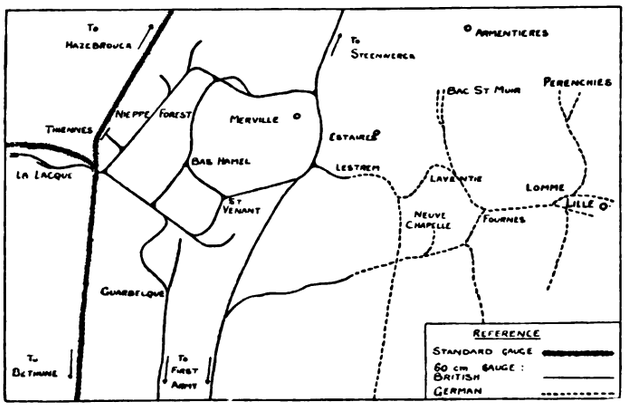
were linked up by the 60-centimetre railway. On these rearward lines steam locomotives were almost exclusively employed, and at one period were run successfully on wood fuel, of which there was an abundance in the neighbourhood.

To-day many of the narrow gauge lines in France, which together with large quantities of locomotives and wagons were some time ago handed over to the French civilian authorities, are being utilised to advantage in rebuilding operations and in connection with the conveyance of agricultural traffic, and here and there



Map of 60-Centimetre Railways.

as a means of transport for tourists visiting the old battle front. Having performed with unqualified success the task for which they were constructed, the narrow gauge railways are thus to-day playing a particularly important part in the work of restoration. For many years prior to the war narrow gauge railways had been utilised very extensively for agricultural and industrial purposes in France, and there is little doubt the 60-centimetre lines recently acquired from our military authorities will prove of immense service in the future development of the country's resources.

AERIAL PHOTOGRAPHY.

There is at least one immediate use to which almost any business concern, municipality, or transport organisation can put the aeroplane. There is no comparison between an oblique aerial photograph of a factory and what has commonly been called a " bird's-eye view " in the past. The " bird's-eye view " is so extremely flattering to the dimensions and general importance of the building that nobody who views the same building from the ground can convince himself that deliberate exaggeration has not been indulged in. The aerial photograph is a plain statement of fact, and therefore a far better advertisement of any really well arranged and considerable premises. Similarly, photographs taken periodically should serve a useful purpose as indicating the development of any new scheme of town planning and the laying out of roads. In such cases we can also advantageously use vertical photographs taken so as to overlap and to form, when placed together, a plan of the whole district where the work is in progress. This process of aerial survey was brought to great perfection during the war, and should now appeal strongly to road surveyors, railway directors, and estate owners. The aerial survey is not so accurate as the ordnance map, but it is far more informative.

TRAMWAY STATISTICS.

COMPILATION BY THE MINISTRY OF TRANSPORT.

The Ministry of Transport recently issued the following report:—

Since 1878 the length of the route open for public traffic in the United Kingdom has increased from 269 miles to 2,728 miles in 1918-19. Of the last-named distance 1,713 miles were owned and worked by local authorities, and 146 miles owned by local authorities were worked by companies. The mileage worked by electrical traction was 2,660, or 97·5 per cent. of the total.

Compared with the last completed year prior to the war (1913-14), the total number of passengers carried has risen from 3,426,473,192 to 4,557,640,078 in 1918-19, an increase of 1,131,166,886, or 33 per cent. In the same period the number of car-miles run has decreased from 354,379,672 to 320,378,376, with the result that the average numbers of passengers per car-mile is now 14·2, as compared with 9·7 in the year 1913-14.

The number of journeys per head of the estimated civil population works out at 108, as compared with 74 in the year 1913-14; whilst the number of passengers carried per mile of route open was 1,668,122, an increase of 400,387, or 31·6 per cent. on the pre-war figure.

The number of local authorities who have obtained powers in connection with railless trolley undertakings is 26, and of these only seven actually carried passengers. Of the total five companies have also obtained powers, of which only one was operated during 1918.

FUEL PRICES AGAIN RAISED.

The petrol distribution companies announced on August 31 that the market position in the United States was so much against them that they were compelled to increase the price of first grade petrol by 11d. per gallon and second grade by 7d. The retail prices are thus as follow—

	Present Price.	Old Price.
First grade	4s. 7½d. ...	3s. 8½d.
Second grade	4s. 1½d. ...	3s. 6½d.

Benzol has gone up 8d. per gallon. The increases will to some extent disturb the motor industry, which had settled down to the effects of the 5d. addition made in March last. Commercial vehicles using second grade spirit are likely to have to raise their tariffs to make up for an addition of a third of a penny per mile to their running costs, while a full penny increase in operating expenses will be entailed upon heavy lorries. Public passenger vehicles will also be affected, and the rise may have an adverse effect upon the prices at which vehicles are sold.

Imperial Motor Transport Conference.—The conference being arranged by the Imperial Motor Transport Council will be held in the Pillar Hall of the Olympia Building, West Kensington, on October 18, 19, 20, 21. There will be two sessions daily for the discussion of various problems and developments connected with Empire fuels, roads and transport. At the time of the conference the main Olympia building will be devoted to the exhibition of commercial motor vehicles, organised by the Society of Motor Manufacturers and Traders. This will be the first representative show of its kind since the war. Delegates at the conference will thus have the opportunity of supplementing, by the study of practical developments, the information rendered available as a result of the discussions which will take place.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, SEPTEMBER 16, 1920.

Employees' Demands.

Despite the numerous cases in which tramway employees during the past six months have flouted the area committees and also the National Joint Industrial Council, we incline to the belief that it is still worth while having these organisations in existence. Costly though they are in upkeep and in the expenditure of time, taking the work which has been accomplished as a whole the results have not been entirely useless. Perhaps the greatest difficulty is connected with the matter of grading. Admittedly the men engaged in the heaviest traffic areas are faced by higher living costs than those in a second or third grade area. Yet the persistency with which one of the first grade bodies of employees ignores its own organisation by putting in successive claims for higher pay is a great stumbling block to the successful working of the scheme. Again, some of the recent strikes have exceeded the bounds of reason. One example is the demand that a sufficient number of employees should be engaged on a permanent footing to obviate overtime work in the busiest period of the year. Men who make such a claim must have forgotten that a great expense has been incurred for extra staff to enable the eight hour day to be adopted. It is safe to say, too, that the universal adoption of a swollen staff would provoke an outcry from the majority of men who are not averse from receiving a few shillings extra for overtime. Its effect upon the finances of the undertakings need not be hinted at. With the London County Council added to the long list of tramways upon the rates—its obligation being estimated to the extent of $2\frac{1}{4}$d. in the £ on account of a complete year's deficit—and with every undertaking now raising its fares to the limit of the statutory power, the time has arrived for employees to recognise that in their own interests they must abstain for a while from further demands. The abstention should hold good until the country has had a winter's experience of the increased cost that is taking effect in bread, rent, and coal, supposing that a strike of the miners does not intervene and deprive both wage and salary earners of their means of livelihood. Further demands now can only result in forging fresh links in the chain of high costs for everybody. Besides, another increase in fares is likely to curtail receipts and lead to reduction of staff. The workers at home have never given consideration to the fact that during the war they suffered no real privation and but a small taste of the miseries that overtook the Continent. On the other hand, a large section of the nation has had to endure loss of income with no hope of remedying their lot until the world returns to a normal state. Every concession made to labour serves to give a further turn to the vice in which all alike are held.

Difficulty of Obtaining Rails.

One fears to reflect upon the situation that will ultimately result in British industries from the raising of wages to three and four times above pre-war rates while the men adopt the mistaken policy of lessening their output. On the Clyde, marine engineers are sending orders for castings to Holland, and the difficulties raised by labour were referred to by Sir J. W. Beynon, a South Wales colliery director and president-elect of the Institution of Electrical Engineers, at their Cardiff meeting, as the main reason why ironmasters are selling their products at prices which could only be described as fantastic. These prices, he said, might enable them to

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compete in their own markets, but will debar them from obtaining business in the markets of the world when times are normal. Several British tramway undertakings have been forced to place orders for rails in the United States, and now that Holland has become a serious competitor we may have to look for her to share with Belgium the place which the latter country held before the war as a rail-making competitor of this country. At present the Belgians are occupied with the problem of making good the devastation of war within their own boundaries. Object lessons such as those we have mentioned may be of real advantage if their effect is to cause British labour to listen to the voice of reason. Probably because of the dual effect of working costs and shortage of raw materials, the British rail manufacturers are, to quote the Mayor of Portsmouth, not in the market. His worship, who is chairman of the tramways Committee, has informed the Corporation that the manager had advertised several times for rails required for the construction of an extension, which was needed for public convenience and to provide work for the unemployed. No response had come from British firms, and the contract had been given to the United States Steel Products Company, although they are unable to give a definite date for delivery. British labour may be reminded that its failure to give adequate production has already injured our greatest industry. For lack of cargo, shipping owners have cancelled orders for new vessels, and for the same reason shipping is being laid up. For a time at least lower freightage rates have been accepted, and consequently foreign manufacturers will be able to put up keener competition against British products.

Platform Collection of Fares.

When women conductors were placed upon the cars during the war several managers adopted the system of collecting fares on the platform. Although the object was the commendable one of saving the women from fatigue, the procedure was an acknowledgment of the merits of the pay-as-you-enter principle. That system when experimented with at Leicester and Aberdeen prior to the war was popular with the conductors, and although public opposition led to its abandonment it is not unlikely that if the cars with enlarged platforms had been running during the war they would have been in operation now. Consideration for the women conductors would have tended to secure a longer trial of the experiment, while the impossibility of finding labour to alter the cars back to the usual design would have prevented their withdrawal. When platform collection was adopted for the convenience of the women conductors, managers rightly recognised that it is impossible to attempt to take every fare on the platform. In some towns conductors were instructed to ask for the fares of top deck travellers only; in other places the order was to apply the innovation when only three or four passengers were taken up at one time. If worked on these lines there is no reason why platform collection should not be again adopted as a means of expediting car operation. To attempt to take every fare when half a dozen or more passengers board a vehicle will result in general complaint. Moreover, that course would defeat the object of quicker working, for with more than three or four persons standing round the conductor there will be obstruction of others who are waiting in the roadway to mount the step. The feasibility of securing more commodious platforms is a matter that might engage the attention of managers in view of the large number of cars that have yet to be secured to make up for the war shortage. The ideal car should provide not only for payment on entry, but for exit by the front platform.

More Transport Facilities Needed.

There can be no question that the riding habit is increasing enormously among all classes. Not the least cause of this growth is the expansion of facilities by means of motor traction. Motors for public services are not only supplementing railways and tramways in urban areas, but they are penetrating rural districts that without them could not enjoy the mobility that is indispensable to the active life and business of any modern community. This is all to the good, and although certain branches of the motor industry may presently suffer a temporary check, we believe that the coming development of road transport will surprise even its keenest advocates. If this prove true every department of the traction industry will be the gainer. Ten years ago the abolition of tramways was

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predicted as freely as it is to-day; but the tramway is now even more essential than ever before. The urgent necessity of economy prevents any thought of its supercession, but it has every reason to welcome the aid of the motor in providing new facilities and in still further developing the riding habit. It is satisfactory therefore to note the increasing interest taken by tramway committees in motor traction and their growing recognition of the part the motor vehicle must play in their respective communities. It is desirable that they should lose no time in providing in this way for the urgent needs of the public. Further tramway extensions will come in due time; but at present railless systems are clearly indicated as being generally the more practicable solution of the local transport problem.

RECENT PUBLICATIONS.

"Historical Sketch of State Railway Ownership," by W. M. Acworth (John Murray, London, 3s. 6d.), is a useful contribution to the literature of the subject. Mr. Acworth has been recognised for many years as an authority on railway management, and he gave evidence in 1917 to the joint committee appointed by the United States Congress to investigate the railway position, with special instructions to report on the history of State ownership in foreign countries. Mr. Acworth also served as a member of a Royal Commission appointed to advise the Canadian Government as to its future railway policy. Mr. Acworth gives the experience of State ownership of railways as practised in Prussia, Switzerland, Italy, Australia, and elsewhere, and he declares that railway history conclusively refutes the idea that State ownership promotes railway development. The evidence he adduces is certainly impressive. Private enterprise being bolder and more ready to take risks than a State organisation, he shows how the American companies revolutionised their machinery and methods of carriage, while in Prussia the State clung to old machinery and old methods. Private companies have led the way in railway development, and State systems have been content to come up behind. Mr. Acworth also shows that in democratic States political influences have interfered with business management. He suggests that it should be possible to arrange a scheme of management on the lines put forward by Mr. Justice Sankey for the coal mines. Management by the people, he says, is not necessarily management for the people. If there were a permanent State railway organisation, with its own board of management, with its own separate budget, and entirely independent of Parliamentary control, but controlled where necessary, like any private company, by a judicially minded Railway Commission, required also like a private company to earn a dividend for its stock-holders—the people—then, and not till then, says Mr. Acworth, will the main objection to Government railways in a democratic State have lost its force.

"The Motor Transport Year Book and Directory" (Electrical Press, Limited, 13-16, Fisher Street, W.C.1, 20s. net) for 1920 is a work valuable because of its wealth of data for reference, which increases year by year. Its compiled record of the public motor transport undertakings and facilities of the British Isles is unique for its completeness, while the informative chapters dealing with the law, taxation and regulations governing motor transport services will be welcomed as giving in a handy form the answer to perplexing questions which arise every day. The financial, statistical, and descriptive survey of motor transport undertakings, public and private, will cause the book to be frequently consulted by all connected with the motor transport business. Over 1,300 undertakings are dealt with, and 4,000 names and addresses are given of directors and officials engaged in transport services and the motor manufacturing industry. An indication of the growth of the interests involved is the fact ascertained from this book that £97,000,000 is the approximate amount of capital invested in motor transport undertakings and services. This is an advance on the past year of no less than £35,000,000. Hardly any other industry can point to such a phenomenal growth, and the compilers of the year book and directory are to be congratulated on serving so effectively in their annual volume such an important industry.

"The Enginering Enquiry," by Tomey Thompson, A.M.I.E.E. (J. W. Arrowsmith Limited, Bristol, 7s. 6d.), is a handbook which should be of great assistance to engineers, agents, contractors, estimating, commercial and technical correspondents, merchants, their representatives and salesmen. The 367 pages contain just that information, set out in a concise manner, which is needed to obviate delays between purchaser and manufacturer. Experience has too often proved that an original enquiry is lacking in just the essentials which would make it clear, and from which a definite tender could be made. Cross correspondence, telephone calls, telegrams, and even cabling follow, and the lack of precision in the original demand cause delay and expense. Had this book been at hand the original inquirer could have set out clearly yet briefly just the information needed. The book will have the effect of standardising forms of enquiry for almost every kind of plant. It would not be surprising if firms should not give bulk orders for the book so as to distribute copies among potential customers. For firms with a foreign trade of any dimensions the haphazard methods in vogue at present must cause costly delays.

Municipal Year Book.—This valuable work of reference has made a welcome reappearance from the *Municipal Journal* offices, after an interval of five years. Priced at 21s. net, its 530 odd well-printed pages are a literal mine of information regarding the local authorities in the British Isles and their work. The entire book has been re-written, and now covers the many changes that have taken place in Local Government powers and administration during the years of the war and since. All that one may desire to know about the Ministry of Health, municipal corporations, county councils, urban and district councils, is given in a concise form, and in the section dealing with the Ministry of Transport such new problems as municipal motor services are discussed, and the latest information given on the present working of such schemes. Similar detailed data is published regarding tramways, libraries, drainage, gas, electricity, and water undertakings which are under municipal control, and in all cases there are short articles dealing with the general legislation affecting the subject of the section. There are nineteen sections in all, one being devoted to special features of municipal enterprise in various towns. The new housing legislation is also fully dealt with, together with details of town planning schemes.

MUNICIPAL TRAMWAYS ASSOCIATION.

PROGRAMME OF ANNUAL CONFERENCE, SEPTEMBER 15-17.

The annual Conference of the Municipal Tramways Association, as previously announced, is being held at Cardiff from September 15 to 17. The official programme is as follows:—

WEDNESDAY, SEPTEMBER 15.

10 a.m. Meeting of the Executive Council in the Council Chamber, City Hall, Cardiff.

10.30 a.m. Reception by the Lord Mayor (Councillor F. G. Forsdike, J.P.) and the members of the Cardiff Corporation Tramways Committee in the City Hall.

11 a.m. Conference.
Presidential address by Alderman Sir John W. Courtis, J.P., chairman of the Cardiff Corporation Tramways Committee. To be followed by papers on "Tramway Finance," as follows—"Fares," Councillor Higham, chairman, Blackburn Corporation Tramways Committee; P. Priestly, general manager, Liverpool Corporation Tramways.

1 p.m. Luncheon in the City Hall, at the invitation of the chairman and members of the tramways committee.

2.30 p.m. Resumption of Conference.
"Operating Costs: Power Expenses," by A. L. C. Fell, O.B.E., general manager, London County Council Tramways.

5 p.m. Adjournment of Conference.

8 p.m. Reception by the Lord Mayor and Lady Mayoress in the City Hall, Cardiff.

THURSDAY, SEPTEMBER 16.

10 a.m. Meeting of the Executive Council in the City Hall.

10.15 a.m. Meeting of the Managers' Section.

10.45 a.m. Conference resumed. "Repairs and Depreciation in Relation to Capital and Revenue," J. Dalrymple, general manager, Glasgow Corporation Tramways; R. L. Horsfield, general manager, Cardiff Corporation Tramways. "The Future of Capital-revenue Expenditure; Capital Expenditure," R. Stuart Pilcher, general manager, Edinburgh Corporation Tramways.

1 p.m. Annual luncheon of the Association in the Royal Hotel, Cardiff.

3 p.m. Annual general meeting of the Association in the City Hall.

FRIDAY, SEPTEMBER 17.

Excursion to Weston-Super-Mare by boat, thence to Cheddar by chars-a-bancs, provided by the Bristol Tramways and Carriage Company.

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ELECTRIC RAILWAY CONTACT SYSTEMS.*

By SIR PHILLIP DAWSON, M.I.M.E.

I have been requested by the Council to read a paper dealing with the contact systems used on electric railways from which the current to feed the trains is collected. There are two distinct types, the older and the one most generally in use in this country being the conductor or live rail, which is only in use with direct current at pressures varying from 500 to 1,300 volts, though it is proposed to increase the pressure with this system up to 1,500 volts. A conductor rail with a pressure of 2,500 volts has been tried in the United States but has been abandoned, and so far there are no contact rails working anywhere at a pressure over 1,500 volts. The general details of conductor rail construction are well known, and will only be briefly dealt with at the close of this paper.

Where pressures of 3,000 volts, D.C., or 6,000 to 16,000 volts, A.C. or 3,000 to 5,000 volts three-phase are concerned, the questions of safety and of insulation have made it imperative to use overhead conductors. There is one case in this country where an overhead conductor is used with a pressure of 1,500 volts, D.C. The overhead conductor has been used here in order to clear the tracks and yards of live conductor rails.

It is not proposed to discuss the actual question of traction systems in this paper; suffice to say that so far only three countries have decided to standardise any one system for general railway electrification. These countries are Sweden, Switzerland, and Germany, who have definitely adopted the single-phase 16,000 volt $16\frac{2}{3}$-period system with an overhead conductor. France is at the present moment investigating the matter, and it appears probable that if they arrive at any definite conclusion, they will adopt the 3,000-volt D.C. overhead system, thus standardising the voltage as well as the system.

Italy has so far not arrived at any definite conclusion, although the majority of their railways so far electrified are on the three-phase, 16-period, 3,000-volt system. The United States has no definite standard, although the Pennsylvania Railroad appears to have decided on the single-phase system for all future electrifications.

The following are the figures regarding the principal electrifications carried out in the United States—

The New York Central and Hudson River Railroad electrified in 1906, with a 600-volt under-running protected third rail. The mileage of single track electrified to-day is 258.

The Pennsylvania Railroad electrified from 1905 to 1910, the West Jersey and Seashore, the Long Island, and the Pennsylvania terminal with 600-volt D.C. third rail, the total mileage being 466.

The New York, New Haven, and Hartford Railroad electrified at 11,000 volts single-phase, 25 periods, in 1907, 582 miles of single track.

The Pennsylvania Railroad electrified its suburban system in Philadelphia and the Norfolk and Western in 1913 on the single-phase system, 25 periods, at 11,000 volts, and the mileage electrified on this system is now 201, and their extension on the Great Horseshoe Bend is going to be on the same system.

The Milwaukee, St. Paul and Puget Sound Railroad electrified in 1913 on the 3,000-volt overhead D.C. system. This railroad is mainly a single-track mountain railway using locomotives, and there are so far 647 miles of track electrified.

In this country the whole question is under examination as to how far any one system shall be adopted as a standard for general railway operation.

Dealing with overhead construction for railways in a country where traffics are very intense and the hours of service long, the overhead construction has to be a very different thing from what has been so satisfactorily adopted for electric tramways. In this case it is obvious that the overhead construction must present factors of security and safety at least equal to those obtaining on the permanent way, and it must be constructed in such a way as to enable any maintenance and supervision to be carried out in the very limited periods of time available for such purposes.

An overhead conductor can only be utilised where the currents to be collected from it are relatively small, as experience has shown that heavy currents are not only difficult to collect, but also very greatly increase the cost of maintenance.

OVERHEAD CONDUCTORS.

(A) General Principles.

The overhead construction and the collector arrangements on the coaches or locomotives must be such as to make it certain that the collector bow will never be liable to come off the contact wire, and must also follow the contact wire with the utmost flexibility, and for this reason the ordinary trolley-wire construction utilised for tramway purposes is obviously unsuitable; in other words, the risk of a collector coming off the contact wire must be no greater than the risk existing to-day of the wheels of a bogie coming off the track.

The overhead construction must be designed and put up in such a manner that, whilst minimising the risk of failures, the cost of maintenance and the time required for renewal or replacements of any individual portion requiring attention should be reduced to a minimum; at the same time the capital cost must be kept as low as possible.

In 1907, when the first overhead lines for main-line purposes were being laid out in Germany, in the United States, and by the Brighton Railway, various principles of construction were adopted in order to fulfil the requirements mentioned above; and it is extremely satisfactory to be able to state that whilst considerable alterations have had to be carried out both in the United States and in Germany, the principles adopted in connection with the overhead construction on the Brighton Railway were such that the overhead construction in operation to-day is practically identical with that originally designed.

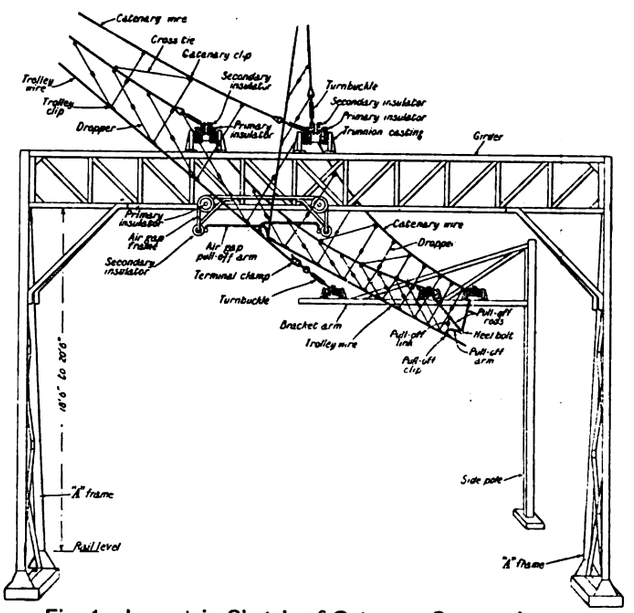

Fig. 1.—Isometric Sketch of Catenary Suspension on L.B. & S.C.R.

Distance between standards, 50 ft. to 210 ft.
Distance between trunnions, 2'5 ft. to 7 ft.
Distance between droppers, 10 ft.
Trolley wire, 7/0 S.W.G.
Catenary wire, galvanised steel 12/13 S.W.G.
Dropper wire, galvanised steel 6 S.W.G.
Strain on trolley wire, 18 cwt. at 60° F.
Breaking strain of trolley wire, 22 tons.
Elastic limit of trolley wire, 19 tons.
Weight per yard of trolley wire, 2'26 lb.
Stagger of trolley wire, 9 in. from centre (present); 12 in. from centre (proposed).
Size of pull-off rods, $\frac{3}{4}$ in. steam tube.

The Germans adopted in the case of the Hamburg Suburban Railway single insulation and a system utilising counterweights for keeping up the tension of the trolley wire, both of which have proved unsatisfactory for such type of work.

In the United States they at first adopted an entirely rigid form of overhead construction, practically a triangular girder, the three longitudinal members of which were the two catenary supporting wires and the trolley wires, which were kept in position by tubular stays. It was found necessary to add a flexible wire under this triangular construction, as the solid conductor wire resulted in hammering and conduced to failures.

On the Brighton Railway the principles adopted in 1907 were:—

That the conductor wire should be as flexible as possible, and that all hard spots should be avoided.

That double insulation was essential, and that the mechanical as well as the electrical factor of safety of the insulators and overhead construction must be very considerable.

That all insulators should be placed in positions where they would be least subjected to the direct effects of the hot gases given off from the steam locomotives.

That, with the exception of complicated yards and cross-overs, the up and down lines should be sectionalised so as to be able to be cut out independently, whilst the complicated cross-over roads and yards were designed in such a way as to be sufficiently short to be coasted over.

That insulators should be only utilised under compression, and that elastic substances should always be placed between the insulator and its solid support, as well as between it and the mechanical construction which it supported.

* A paper read before the Institution of Electrical Engineers.

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Provision was also made when designing the insulators that there might be no possibility of moisture or water collecting and freezing, thereby fracturing the insulation.

The general arrangement in use and the principal parts, as well as their chief dimensions and nomenclature, are shown in the accompanying isometric sketch (Fig. 1), which was prepared for the use of the employees of the railway so that they might be familiar with the names and uses of the various parts.

This 3 in. clearance has worked quite satisfactorily, though, of course, a minimum clearance of four inches between the loading gauge and the live wire is worked to when possible. It is considered that four inches will be quite satisfactory for 11,000 volts.

Electrical Clearances between Bow Gear and Structure.—Four inches is considered to be the minimum vertical point-to-point electrical air clearance which should be allowed for voltages from 6,000 to 11,000; therefore a minimum of four inches vertically

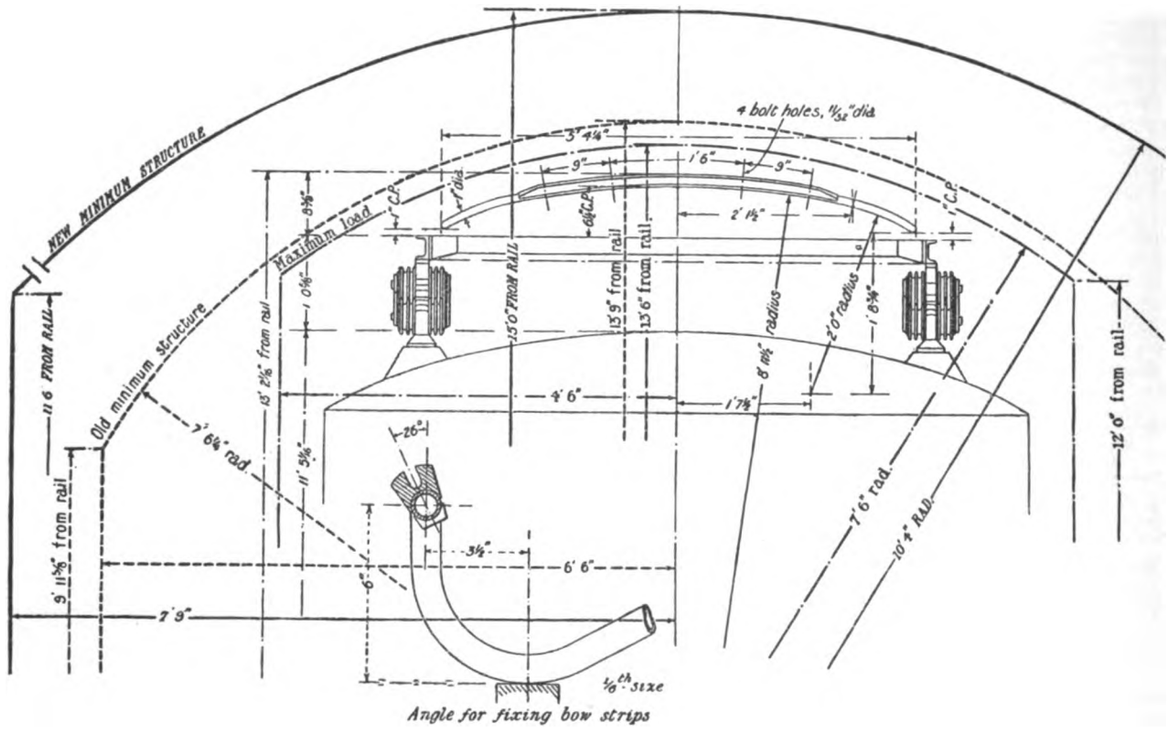

Fig. 2.—End View of Bow Gear showing clearances.

(B) CLEARANCES.

Limiting factors in the erection of an overhead conductor system are the clearances at bridges, in tunnels, and under any other structures which are necessary for electrical purposes, between the live conductors and the loading and construction gauges. Fig. 2 shows the various clearances existing to-day between the live portions of the bow gear, the loading gauge, and the old and new minimum structure gauges on the Brighton Railway. It will be seen from this diagram that the contour of the bow practically follows the contour of the loading gauge, also that under present conditions the ordinary running width of the bow is 18 inches, or nine inches on either side of the centre line. This is the stagger at present adopted for the overhead construction on the Brighton Railway, although for the future, in consequence of the experience gained, this stagger will be increased to a maximum of one foot on either side of the centre line. The width of the actual collector strip is nine inches greater on either side of the centre line (in addition to the nine inches allowed for stagger), or 18 inches in all on either side of the centre line, in order to allow for the rolling of the coach and for special conditions existing on very sharp curves, and this has been found ample in practice.

The general conditions of clearances which govern our construction are as follows:—

Height of Live Conductor above Rail Level.—The lowest live conductor on the L.B. and S.C. Railway is 13 ft. 9 in. above rail level, i.e., three inches above our loading gauge. This happens at Tennison Road Bridge, Gipsy House Bridge, Boutflower Road Bridge, St. John's Hill Bridge (up main), and Larkhall Rise Bridge.

and three inches horizontally is provided from any part of the live bow to a structure at any height after the proper allowance for rolling has been made. The rolling allowance in the case of the Brighton Railway is five inches on either side when the centre of the bow is at 16 ft. above rail level, which is the normal height of the trolley wire.

Electric and Mechanical Clearances between Overhead Equipment and Structures.—In this case it is also considered that the minimum point-to-point electrical air clearance from any live part of the overhead line equipment to the structure should not be less than four inches vertically and three inches horizontally for voltages from 6,000 to 11,000.

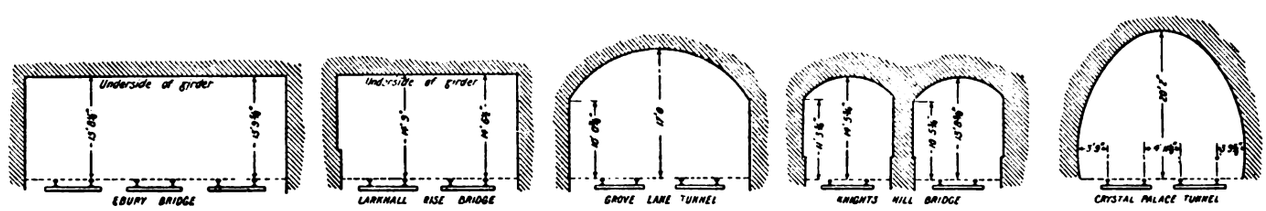

Fig. 3.—Examples of Low Bridges and Tunnels on the L.B. & S.C. Railway.

There is a case on the L.B. and S.C. Railway where a 2¾ in. air clearance has been running for a considerable period without trouble occurring. For a long time there were four places with a clearance of from 3 in. to 3¾ in. and no trouble occurred. Owing to improved construction, and for the sake of standardisation, these places have recently been improved to give 4 in. clearance.

Minimum Standard Clearances.—Working on the principles given above, we can get a flexible overhead line construction within a minimum of 10 in. from the loading gauge to the structure, i.e., within 14 ft. 4 in. above rail level, which 10 in. space is utilised as follows:—

Four inches—Air clearance between loading gauge and underside of trolley wire.

Two inches—Depth of flexible line construction.

Four inches—Air clearance between top point of live construction and structure

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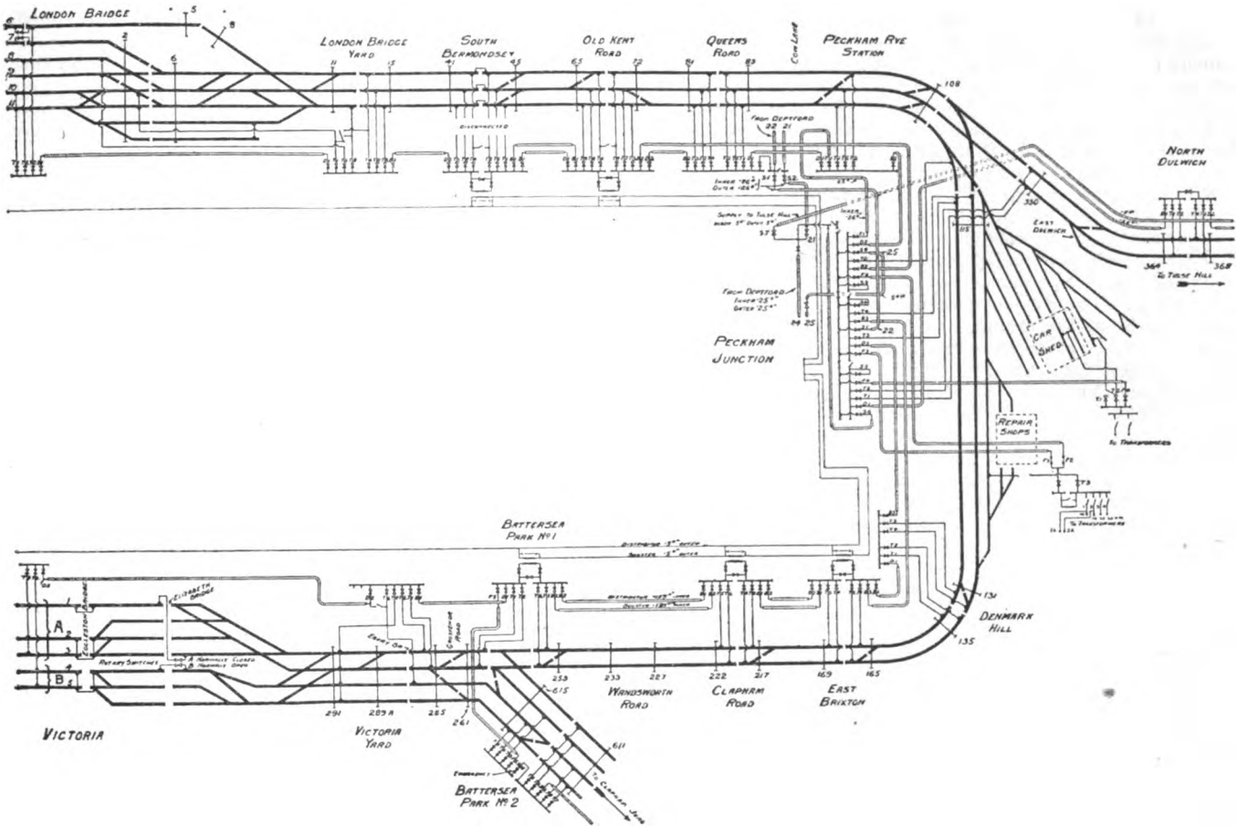

Fig. 4.—Diagram of Connections, Switch Cabins, and Overhead Equipment, South London Line.

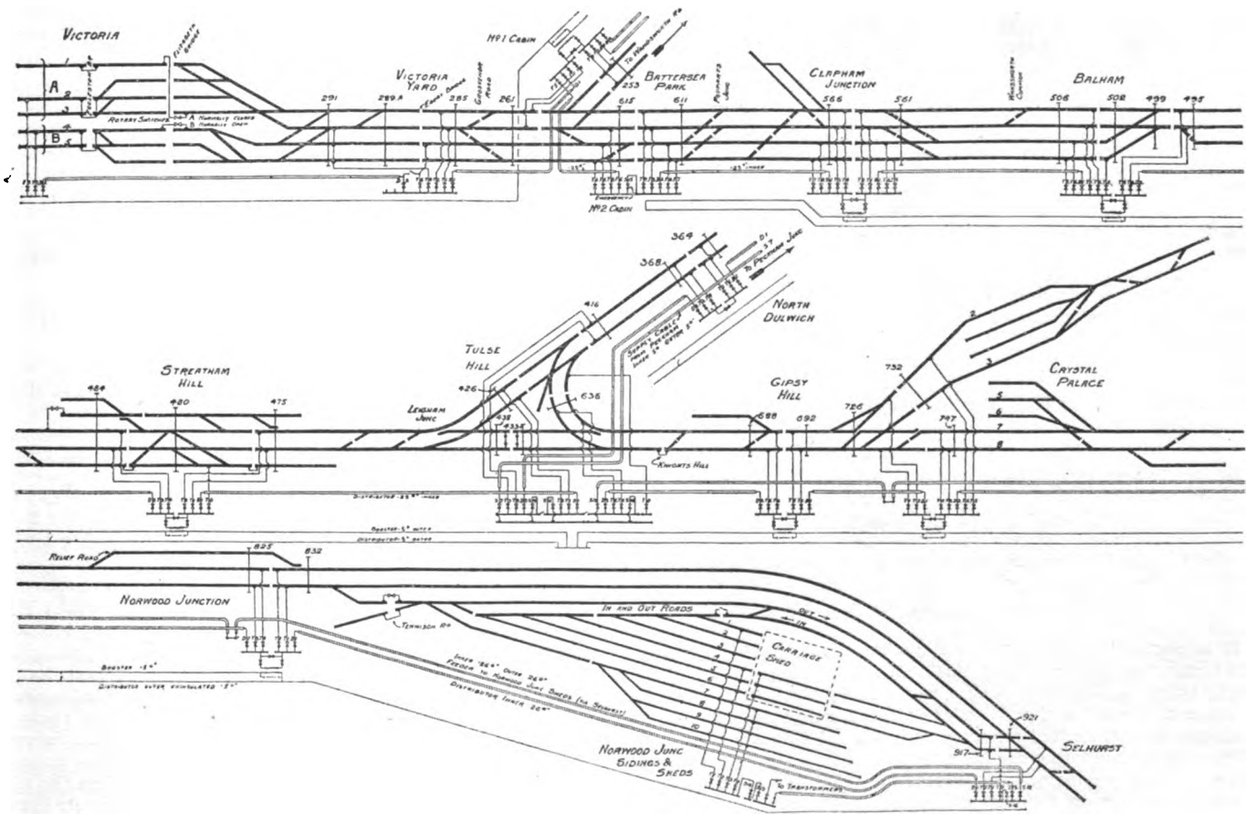

Fig. 5.—Diagram of Connections, Switch Cabins, and Overhead Equipment, Crystal Palace Lines.

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There are probably twenty cases of six inches overall from the underside of the live wire to the nearest structure, running satisfactorily to-day; and two of 4½ in. where there is a short space of about 12 ft. under the footbridges at Streatham Hill and West Norwood, in which two cases the "live construction" consists of a single trolley wire supported at either end of the bridge.

Fig. 3 gives the section and dimensions of some of the worst cases that have had to be dealt with.

In practice it has been found that there are a few isolated cases where the clearances required for a live conductor are not available, and where the cost of alterations necessitated to procure these would be excessive and would not be justified by the results gained. On the whole of the running lines so far electrified, equivalent to 70 miles of single track, there are only four instances where sufficient clearances for a live conductor do not exist. Three of these occur at the bridges at the entrance to or in Victoria Station, where, owing to the lack of clearance, it has been found necessary to instal earthed conductors. One of these bridges just outside the station—Ebury Bridge—is shown in Fig. 3 in section, and the two others are Elizabeth and Eccleston Bridges. The difficulty in the case of Victoria Station is accentuated by the fact that owing to men having to circulate on the roofs of steam trains in Victoria Station, the height of the trolley wire inside the station is 19 ft. 9 in. above mean rail level, and the drop from this level to the level under the bridges is 5 ft. 10 in., which is dealt with at a gradient of 1 in 10, as the maximum speed at which the gradients have to be taken does not exceed 25 miles per hour. In order to avoid danger of short circuits, a neutral section is interposed between the live wire and the earthed section under the bridge. The contours of these sections have been designed in such a way that they take care of the inertia of the bow and the rapidity with which it rises and falls, with the result that there is practically no hammering of the bow when entering or leaving these sections.

One other bridge necessitating a dead section is on the up side at Knight's Hill, close to West Norwood Station, also shown in Fig. 3. Another flat and very low bridge is Larkhall Rise on the South London line, shown in Fig. 3, but in this case a live wire is carried through the bridge. Another very low and difficult structure is Denmark Hill tunnel, on the South London line.

(C) Sectioning of System.

As has already been mentioned, the line has been divided into sections which can, if necessary, be isolated from each other with a view to locating faults and to minimising any delay that might be caused thereby. The general system adopted is clearly shown in the diagrams of connections (Figs. 4 and 5), which represent every overhead conductor installed and the entire switching gear and distribution system used to feed and control the whole system.

It is obviously necessary to sectionalise the line, and the only satisfactory manner of doing this without limiting the speed at which trains can traverse such sections is by the use of air-gaps at the end of each section. Under ordinary conditions, and where there are no complicated crossings or junctions, this is a very easy matter, as one conductor can be brought to a terminal and anchored whilst another conductor is started at the point of section, so that the collector bow on a short section runs in contact with the conductor wires of two adjacent sections.

However, at certain points and crossings and complicated junctions this was found to be a very difficult matter. Both in Germany and in the United States this difficulty has been met by putting in section insulators mechanically connecting the adjacent sections. Experience has shown that this method caused flashing and knocking of the bow collector, causing complications and limiting the speed at which such connections can be negotiated. This difficulty has been entirely overcome by the special patented device designed for the Brighton Railway.

It has already been stated that whilst on ordinary running lines the up and down lines are easily sectionalised, there are one or two cases of cross-overs, junctions, and the yards of terminal stations where this may become difficult, and the special air-gap insulator mentioned above has been of great assistance in overcoming such difficulty. Here the whole of the overhead line is electrically and mechanically connected and formed into what is known as junction sections.

Each of the junction sections is separately fed and controlled, as may be seen by reference to Figs. 4 and 5. These junction sections are so laid out as not to exceed a length which can easily be coasted over should a defect render it necessary for one such section to be cut out.

(D) Maintenance.

In connection with the electrification of the Brighton Railway, there is one section between Battersea Park and Peckham Rye on the South London line over which there is practically no steam traffic, and which is practically entirely operated electrically, whilst on the other electrified sections, and particularly on the Crystal Palace line, there exists in addition to the electric service a very heavy steam service, which during the years of war was exceptionally heavy on the Crystal Palace line owing to the abnormally heavy munition traffic handled by the Brighton Railway.

As will be seen from the following diagrams, which have been taken from the very careful records kept during the last ten years, the maintenance costs and renewals of the overhead construction are very largely affected by steam operation.

The efficiency of the overhead system as regards the very small number of defects and delays arising therefrom is shown in Fig. 6. The larger number of defects in 1911 and 1912 over those in 1913 is due to the fact that the Crystal Palace line was opened in May 1911, before it had been really properly completed owing to the Festival of Empire, and the drop of defects in 1913 is due to these having been remedied. The rise after 1914 is entirely due to the war, owing to the heavy munition steam traffic over the Crystal Palace line. Even so the defects which caused delays exceeding half-an-hour are extraordinarily rare.

Fig. 7 shows the percentage of both the primary and secondary insulators renewed on the whole system per annum; whilst Fig. 8 shows the total number and percentage of primary and secondary insulators renewed on the South London and Crystal Palace lines. It will be seen from the top figure of this latter diagram that not a single primary insulator has been renewed on the wholly electric section of the South London line. Considering that there are altogether 7,000 primary and 14,000 secondary insulators, the result shown can be considered to be eminently satisfactory.

Fig. 9 shows the percentage of trolley wire renewed on the whole of the overhead system since it was first operated electrically in 1909. As has already been mentioned, the wear of the trolley wire is largely if not entirely dependent on the amount of current collected.

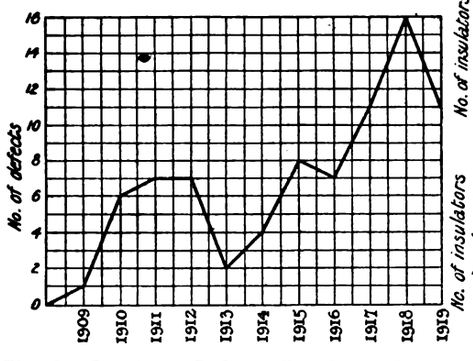

Fig. 6.—Overhead Defects Causing delays to Traffic Working Exceeding 3 Minutes.

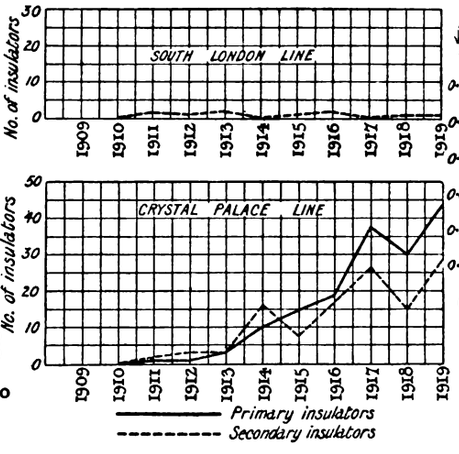

Fig. 8.—Insulators Renewed on account of deterioration.

7,000 primary and 14,000 secondary insulators in use.

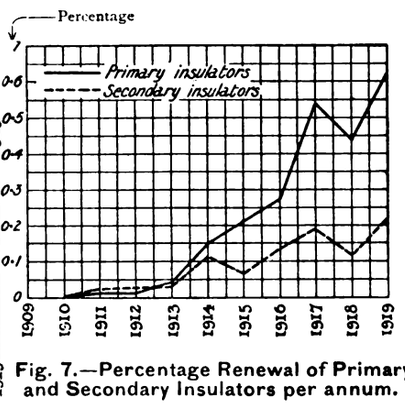

Fig. 7.—Percentage Renewal of Primary and Secondary Insulators per annum.

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This is borne out by the actual measurements carried out during the last ten years, the results of which are recorded in Fig. 10. It will be seen from the two top figures of this diagram that the wear on the trolley wire where no current is taken is nearly negligible, and the data given on this diagram are typical of measurements made at a very large number of structures at other places where no current is collected, and are borne out by the amount of trolley wire which has actually had to be renewed during the past 10 years.

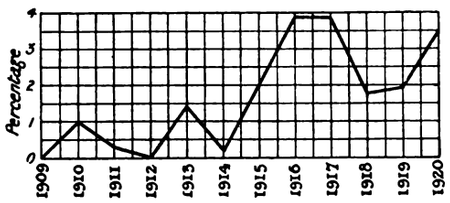
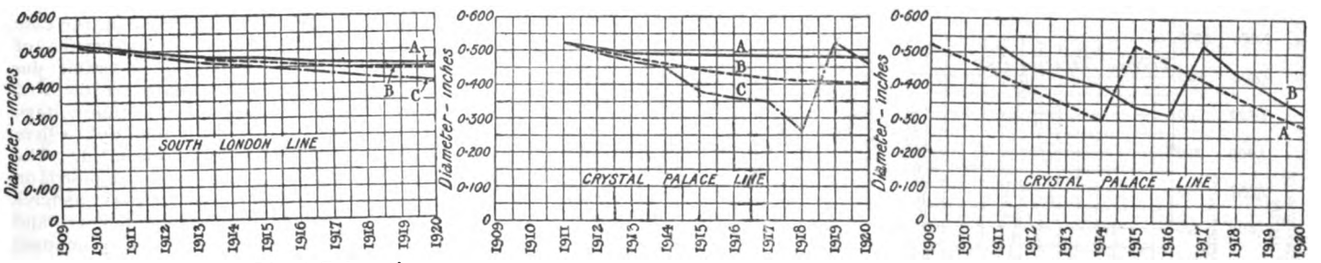


Fig. 9.—Percentage Renewal of Trolley Wire per annum.

That the wear is proportional to the amount of current collected is shown by all three diagrams in Fig. 10, and is corroborated by many other measurements made where heavy and medium currents have to be collected.



A. St. No. 214 Down line. East Brixton to Clapham-road. No current.
B. St. No. 189 Up line. Clapham-road to East Brixton. Running current.
C. St. No. 170 Down line. East Brixton to Clapham-road. Starting current.

A. St. No. 666 Up line. Gipsy Hill to West Norwood. No current.
B St. No. 587 Up local. Clapham Junction to Battersea Park. Running current.
C. St. No. 68 Up local. Clapham Junction to Battersea Park. Starting current.

A. St. No. 286 Down local. Victoria to Battersea Park. Lower part of Grosvenor Bank. Heavy running current.
B. St. No. 666 Down line. West Norwood to Gipsy Hill. Starting current.

Fig. 10.—Relative Wear on Trolley Wire.

Figs. 11 and 12 show the percentage of catenary and dropper-wire renewals during the last ten years. Here again the large increase in these renewals during the years of war is practically entirely due to the extraordinarily heavy steam traffic.

The influence of steam on the maintenance of catenary and dropper wires is clearly shown in Fig. 13. The top figure represents a typical one-mile section of the South London line, which is operated entirely by electric traction, where not a single catenary wire has been renewed. There are 150 miles of catenary wire, so that the amount renewed has been very small.

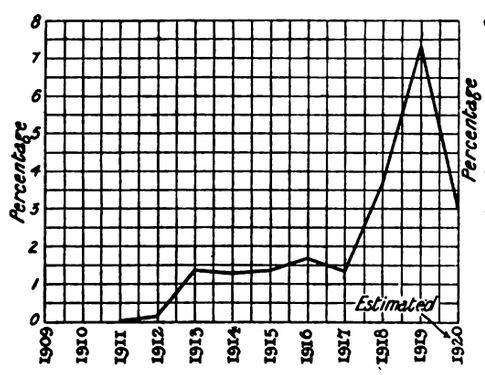


Fig. 11.—Percentage Renewal of Catenary Wire per annum.

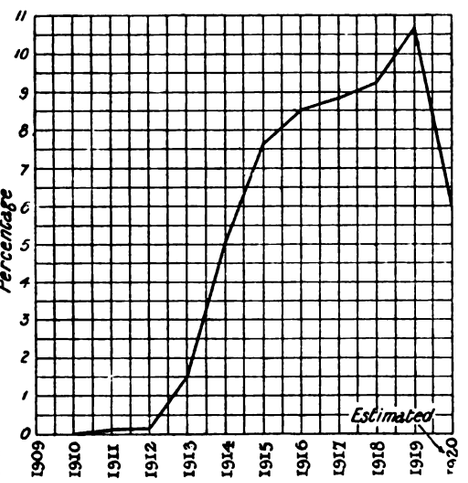


Fig. 12.—Percentage Renewal of Dropper Wires per annum.

The two other diagrams in Fig. 13 show two parallel lengths of a mile on the Crystal Palace line, one with very little electric and very heavy steam operation, and the other the local line, on which there is a mixed steam and electric service, from which it will be seen that the lines over which there is the greatest steam traffic are subject to the greatest cost of maintenance.

The experience gained on the Brighton Railway, where very great precautions were taken in order to ensure absolute safety of operation, has shown that a simpler form of construction, and one which will considerably decrease the cost of construction and maintenance, can be adopted, and one has been designed and tried and will be employed in any extensions which may be carried out.

(E) OVERHEAD CONSTRUCTION ADOPTED BY OTHER RAILWAYS.

Having discussed the overhead construction in use on the Brighton Railway for the last ten years, the author exhibited a few illustrations of the systems adopted by other railways, comprising the Pennsylvania, the New York, New Haven and Hartford Railroads, the Prussian and the Swedish State Railways.

CONDUCTOR RAILS.

(*a*) *General Remarks.*—When we deal with the question of conductor rails, it may be observed that owing to the large mileage of these installed in this country there is a very considerable amount of information available regarding them which has been published from time to time both in papers which have been read before the various institutions and in articles published in the technical Press.

(*b*) *Types of Conductor Rails.*—At the present moment there are three types of conductor rails in general use if we consider them from the point of view of form of current collection.

Over-running, where the shoe rests on the top portion of the rail, being kept there by means of gravity or springs, as is the case on the Underground Railway system, the London and South-Western, the North-Eastern, the London and North-Western, and the Lancashire and Yorkshire Liverpool-Southport line.

Under-running, where the current is collected from the lower surface of the rail, the rail being supported from the top and the contact being pressed upwards by means of springs against the conductor rail. This system is not at present in use in this country, although installed to a very considerable extent in the United States and on the Continent.

Side-running, such as was designed and installed by Sir John Aspinall on the Manchester-Bury section of the Lancashire and Yorkshire Railway, where the current is collected from the side of the conductor rail by means of a collector pressed laterally against the conductor rail by means of springs.

(*c*) *Some Construction Details.*—Conductor rails have to be interrupted at crossings and at complicated portions of the track, and in order to enable trains to leave and again make contact with the conductor rail at high speed either vertical or lateral ramps have to be installed to bring the collector shoe into gradual touch with the conductor rail.

Jumper cables have to be provided in order to connect electrically the different sections of the conductor rail system, and experience has shown that where possible these should be laid either above ground or on the surface, so as to be easily accessible from the point of view of repairs and maintenance. Provision has also to be made by means of section switches or links to sectionalise the conductor rail so as to be able to isolate portions of it when required, in order to renew or repair portions of the track or in case of derailment.

The shape of the conductor rail varies very much, and no standard exists for this at present, neither has any standard yet been definitely adopted by all railways for the height or actual position of the conductor rail. The rails must be of a special chemical composition, so as to give the highest conductivity consistent with durability.

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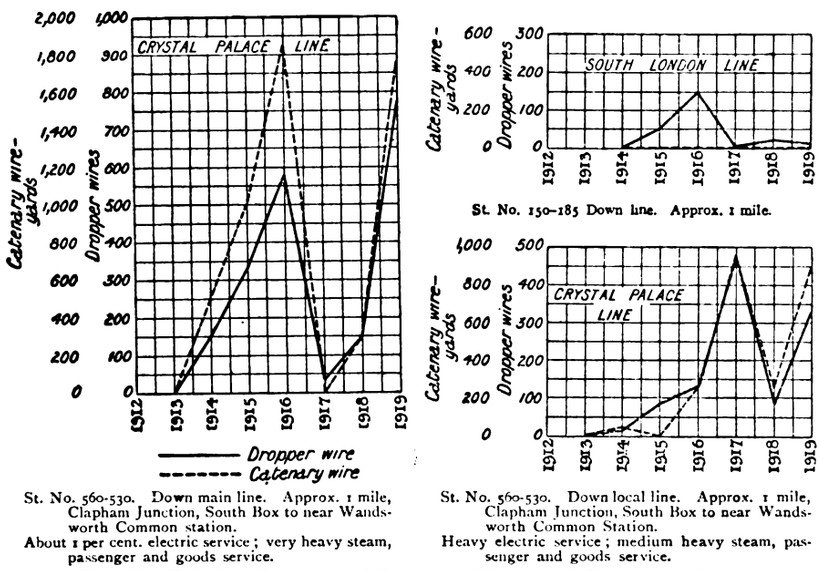
Referring to the question of gaps, with pressures up to 1,300 volts, no very great troubles with over-pressures have so far been encountered owing to contact shoes making and breaking contact, and it is therefore quite possible to coast over lengthy gaps where multiple-unit trains are used. This becomes difficult if not impossible where electric locomotives are used to haul heavy loads, and where a gap would mean a complete interruption of energy to the train. In order to overcome this difficulty both on the New York Central and Hudson River Railroad and on the Pennsylvania Railroad, on complicated sections where the conductor rail has had to be interrupted an overhead construction to carry an overhead conductor rail has had to be installed.

With conductor rails operating at 600 volts, experience has shown that under normal conditions no protection is required or advisable, and, in fact, there are many cases where such protection having been originally installed has now been removed, not merely to reduce the cost of maintenance, but because it has been found that a conductor rail without such protection formed a smaller obstruction to the operating staff than a protected one. Notwithstanding the great mileage so far installed, the number of fatal accidents due to persons coming into contact with the conductor rail is very small, and such accidents have more generally occurred in the case of trespassers than of employees.

Where, however, a pressure of 1,200 or 1,500 volts is in use, the conductor rail must be protected, and a very suitable form of protection for a side contact has been adopted by the Lancashire and Yorkshire Railway on their Manchester-Bury section. The most suitable material for this protection in this country has been found to be Jarrah wood.



St. No. 560-530. Down main line. Approx. 1 mile, Clapham Junction, South Box to near Wandsworth Common station.
About 1 per cent. electric service; very heavy steam, passenger and goods service.

St. No. 150-185 Down line. Approx. 1 mile.

St. No. 560-530. Down local line. Approx. 1 mile, Clapham Junction, South Box to near Wandsworth Common Station.
Heavy electric service; medium heavy steam, passenger and goods service.

Fig. 13.—Relative Renewal of Dropper Wires and Catenary Wires.

Whilst on certain railways in certain cases it has been found necessary to anchor the conductor rail, experience on other lines seems to show that this is not always either necessary or desirable.

Insulators at present in general use are made of porcelain, earthenware, "Siluminite," reconstructed granite, and various other substances, and the normal spacing is about 9 ft. or 10 ft. apart.

The only serious delays which have so far been caused in this country in connection with the conductor rail system are in the case of those railways where top contact is made when abnormal weather conditions have caused the rail to be covered with a thin layer of ice.

As regards the question of wear and tear, it is very difficult owing to the varying conditions of climate, operation and location, to come to any definite conclusion, but experience in the open air on the Metropolitan District Railway would seem to indicate that the loss of rail due to wear and tear and corrosion may be taken at something like 1 lb. per yard per annum, half of which is due to wear and the other half to corrosion.

(*d*) *Systems for Conductor Rails.*—So far as the systems of conductor rail adopted in this country are concerned, it may be said that there are two definite principles at present in operation and a third has been proposed. In the case of the Metropolitan and the Metropolitan District Railways, owing to the fear of the drop in the return circuit being limited to such a figure by the Board of Trade as to make it difficult to realise with an ordinary track rail return, these railways have adopted double conductor rails, one positive and the other negative, the track rails not being utilised as a part of the return circuit. This arrangement has brought about certain defects in connection with insulation of the apparatus on the trains, particularly when the negative conductor rail becomes earthed from any reason, due to over-pressures. The necessity of using two insulated conductor rails obviously increases both the capital and maintenance costs of the conductor system.

The other system is that adopted by the North-Eastern, the Lancashire and Yorkshire, and the London and South-Western Railways, and is one where only one insulated conductor rail is employed, the track rails being utilised for the return circuit either with or without a supplementary bonded rail or return conductor. This additional rail is bonded to the track rails, and serves merely for carrying current, and is not insulated from earth.

With a view to getting the benefit of 3,000 volts pressure, but at the same time not having to utilise any motors wound for a higher pressure than 1,500 volts, and in order to do away with any large currents returning through the track rails, Mr. Raworth, the electrical engineer of the South-Eastern and Chatham Railway, has proposed the adoption of a conductor rail system requiring two insulated conductor rails per track, the track rails serving as a neutral. A similar system has been running for some years on the Nord-Sud line in Paris, which operates with an overhead conductor and insulated conductor rail, the difference of potential between these being 1,200 volts, and the track rails serving as neutral of a three-wire system.

VOLTAGE DROPS IN EARTH-RETURN CIRCUITS.

(*a*) *Direct Current.*—The permissible voltage drop in the earthed return is the most important factor in the case of direct and alternating-current systems of traction. There have been considerable departures from the original standard as dictated by the Board of Trade for maximum voltage drop in rails of electric tramways where direct-current systems are concerned. The maximum allowance of 7 volts imposed on tramways has compelled such railways as have electrified under Parliamentary powers, and who feared similar regulations being imposed upon them, to instal insulated return-current conductor rails.

Other railways not so situated are operated with rail drops perhaps exceeding for short periods twenty times that figure. Either therefore the Board of Trade limit, as imposed on tramways, is unduly severe if applied to railways, or there is an amount of damage going on by way of electrolysis which must sooner or later involve considerable trouble.

Since sub-station distance, and therefore the economic operation of direct and alternating current systems, are directly affected by rail drop, a time seems to have arrived when some decision should be taken on this point. The anomaly of one railway being afraid of being limited to a 7-volt drop while another is unrestricted should be removed.

(*b*) *Alternating Current.*—At one time it was considered that alternating current had no harmful effect so far as electrolysis was concerned, and in any case this effect is very small compared with direct current.

The Board of Trade has recognised that a higher pressure drop can be admitted with alternating than with direct current. The first regulation laid down was 200 volt-minutes for a period not exceeding 10 minutes, which means that for short periods the drop may be twice as much. The question of cost is very largely governed by the number of sub-stations, and this in its turn is governed by the maximum drop allowed in the track return.

The limitations of rail drop are therefore governed by considerations of economy and of inductive effects. The latter have not proved by any means so troublesome as had been prophesied, the effects of rail impedance being largely counterbalanced by the comparatively small current transmitted in the alternating system.

CONCLUSION.

It is not the intention of this paper to make any comparison between the merits or otherwise of conductor rails and the overhead system, but merely to give information, particularly as regards overhead conductors, about which at the present moment very little is generally known in this country. It is, however, obvious that the presence of a charged rail near the track must increase the cost of maintaining the permanent way. As regards overhead conductors, this difficulty is done away with except for the painting of the valances of the roofs at stations near which the live conductor passes. There will be a slight increase in the cost of painting these due to the presence of the live conductor, but this will obviously be insignificant compared with the increased cost of maintaining permanent way due to the presence of the conductor rail.

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LONDON COUNTY COUNCIL TRAMWAYS.

TRAFFIC CO-ORDINATION PROPOSAL DEFEATED BY ONE VOTE. CHEAP MID-DAY FARES RETAINED.

Negotiations that have taken place between the London County Council and the London Omnibus Combine with a view to a co-ordination of policy regarding tramway and omnibus traffic led to a special meeting of the London County Council on August 24. The proposal before the meeting would have discontinued the 2d. all the way mid-day fare, adopted on March 30 last, pending a result being reached in regard to increase of fares and the co-ordination of traffic generally. As the resolution was defeated by only one vote, it is not expected that the matter has been finally disposed of.

The Highways Committee presented a long report reviewing the steps taken to confer under the auspices of the Ministry of Transport with representatives of the London omnibus undertakings in order to effect a systematic and satisfactory correlation between the various traffic systems. The committee also recalled that in view of the critical financial position of the tramway undertaking, they had been authorised to take such steps forthwith and from time to time as might be required to prevent the undertaking becoming a charge upon the rates.

On August 9, therefore, they applied to the Ministry asking that under the Tramways (Temporary Increase of Charges) Act, 1920, an order be made authorising the following revised scale of charges—

ORDINARY FARES.

1 section of an approximate average length of 0·6 mile for 1d.
2 sections, approximately 1·2 miles, for 1½d.
3 sections, approximately 1·8 miles, for 2d.
5 sections, approximately 3·0 miles, for 3d.
8 sections, approximately 4·8 miles, for 4d.
12 sections, approximately 7·2 miles, for 5d.

Any further distance on one car, 6d., with certain transfers to enable passengers to reach a central terminus for that fare, subject to only one change being made.

WORKMEN'S FARES.

2d. return for 3 sections (without transfers), approximately 3·6 miles total journey.
4d. return for 6 sections (without transfers), approximately 7·2 miles total journey.
6d. return for any further distance with transfers as now given.
Single journey workmen's fares to be abolished.

LORD ASHFIELD'S PROPOSAL.

At the suggestion of the Ministry representatives of the Council discussed the matter with Lord Ashfield, representing the omnibus companies. Sir Francis Dunnell and Sir George Beharrell were present on behalf of the Ministry, and questions were raised as to the date on which the fares should be increased, the amount of the initial fare (which the omnibus companies thought should be 1½d.), and the retention of the cheap mid-day fare on the Council's tramways. Mr. G. H. Hume, for the Council, pointed out that all these questions depended on resolutions of the Council, and that, as the Council was in recess, he had no power to deal with them. Lord Ashfield asked whether if the omnibus companies agreed to the initial fare being 1d., instead of 1½d., the Council would be prepared to agree to the cheap mid-day fare of 2d. being abolished. Mr. Hume replied that something might perhaps be done in the direction indicated by Lord Ashfield, though this was a matter for the Highways Committee and the Council.

The report of the committee stated that there were four questions referred to—

(i.) The date on which fares are to be increased.
(ii.) The amount of the minimum initial fare to be charged.
(iii). The stage points between which the new fares should apply, and
(iv.) The cheap mid-day fare.

The committee is of opinion that the revision of fares on the tramways should not take place before Sunday, September 26, 1920. The report continued—

"In connection with (ii.), the amount of the initial fare, our attention has been called to the fact that Lord Ashfield has stated that all the extra metropolitan tramway authorities (except Croydon), both company and municipal, including those with whom the Council has through running arrangements, have agreed with the omnibus companies as to revised fares to be put into operation and are prepared to arrange for the initial fare on each of their systems to be 1½d. We would point out, however, that the resolution of July 27, 1920, lays it down that there shall be an initial fare of 1d., and further that the interim Order granted by the Ministry of Transport also provides for a fare of 1d. We do not think, therefore, that the Council is in a position to agree with the suggestion of the omnibus companies that the initial minimum fare should be 1½d. As regards (iii.) the general manager has been instructed to get into touch with the officials of the omnibus companies as to the stage points between which the new fares shall apply, and it is not anticipated that any difficulties will arise in settling these.

"With regard to (iv.) which deals with the cheap mid-day fare, we are of opinion that in the event of the omnibus companies agreeing that the initial ordinary fare in London shall be 1d. instead of 1½d., the Council might agree to suspend the practice of charging a cheap fare between 10 and 4, which was introduced on the tramways as an experiment. We wish to make it perfectly clear that the arrangements now proposed are to be entered into on the understanding that they will be operative only for the period which will elapse before either an agreement shall have been come to as the result of the conferences now proceeding with the omnibus companies or until such conferences are broken off." The committee recommended—

> That, subject to the omnibus undertakings concerned agreeing that the fare for one section of an approximate average length of 0·6 mile shall not exceed 1d. in London, the charging of a 2d. maximum fare on the Council's tramways between certain hours of the day for all distances in excess of the 1d. ordinary fare stage, instituted as an experiment under the resolution of March 30, 1920, be suspended as from the date when the new fares, to be charged under the Order of the Minister of Transport, dated August 17, 1920, are put into force.

PLEA FOR MUTUAL UNDERSTANDING.

Mr. W. J. Squires, the chairman of the Highways Committee, in moving the reception of their report, urged that a policy of "give and take" must be adopted if the Council retained their desire to get into touch with the Underground Combine and the Ministry of Transport with a view to arriving at a mutual understanding in regard to the future arrangements of the tramways, omnibuses, and tube railways of London. At the last meeting of the Council a recommendation of the Highways Committee concerning an increase of the normal fares charged on the Council's tramways had been agreed to. In regard to the 2d. fare during the mid-day hours, he said frankly that he had never been in favour of the adoption of that experiment, the net result of which could not be stated, for the figures were not yet available. He regarded that experiment as a direct cut against the omnibus undertakings. If the 2d. fare were done away with the Council would have improved opportunities of reaching a better understanding with all the passenger traffic undertakings in the London area.

Mr. G. H. Hume seconded, and reminded the Council that it was by their unanimous desire that the Ministry of Transport had brought together the Underground Combine and the Council in order to discuss how the cut-throat competition between their undertakings could be eliminated or reduced with the object of making it unnecessary to increase fares more than the conditions of the time rendered unavoidable. He appealed to the Council not to intensify competition while the negotiations were proceeding. If unequal fares and wasteful competition continued he did not know what effect there might be on the negotiations. If the parties failed to come to an agreement the cheap fares could be reimposed. The resolution did not tie their hands, but it met the Ministry of Transport, who had met the Council and whose assitance the Council would still require.

Mr. H. H. Gordon, who opposed the motion, said that during five days after the adoption of the 2d. mid-day fare 100,000 more passengers were carried in the Council's cars than had been carried formerly at the old rates, and the manager said that the only additional expense incurred was the cost of printing the tickets. If the 2d. fare experiment were wrong in principle, as Lord Ashfield had stated, then the Ministry of Transport and the railway companies were wrong in re-establishing excursion fares and urging the public to travel during the middle of the day. He had tried in vain to see how the proposal was to benefit the tramway undertaking. The experiment had proved a success and it was becoming increasingly popular. Commercially the experiment had proved to the hilt, not that the fares were wrong, but that the principle by which they were stated to be wrong was an utter failure. There was no justification for the assertion that it was necessary for the Council to surrender their cheap mid-day fares in order to retain the 1d. fare in London. They were told that in the midst of these delicate negotiations they should do nothing to make matters more difficult but was the obligation not reciprocal? They were also told that if they declined to abolish the mid-day fares the omnibus company would not raise their fares. He was not convinced that that would not be entirely in the interests of the travelling public. If it meant that, despite the ruinous losses the omnibus company were now incurring, the combine were about to engage in a policy of undercutting, would the conditions not have been realised in which the Council would be justified in using all its resources to repel the unfair attack?

If a rate war were contemplated, he was confident that the struggle would not be prolonged and that the end of that struggle would perhaps be a solution of the London problem which would not

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be to the taste of the traffic combine. The appeal came to them reinforced with all the authority which attached to a Government department. The Government had undertaken to pay certain subsidies to the railways, but so far as railways were concerned, the question of competition did not arise. It had frequently been stated that in the subsidy for the railways a subsidy for the omnibuses was included. The Council were entitled to demand that this mysterious agreement which had never seen the light of day should be submitted to them, so that they might know what was the situation which they had to meet. It was an extraordinary situation when the Ministry of Transport had to invoke the aid of the County Council. Too often they had stood patiently by the public entrance of the Ministry while the combine had entered by the private door. The Ministry had a duty to the public, but the Council had a duty to protect the interests of the citizens and to prevent exactions from them, even by the Ministry of Transport. Having regard to the fact that the mid-day fares had proved a great convenience to the public and a great advantage to the tramway undertaking, the Council would be failing in their duty if they surrendered these fares at the half-concealed threats of the combine.

THE REAL ISSUE.

The Rev. J. Scott Lidgett thought that to begin compromising at the start, without any guarantee that the whole principle of co-operation was to be accepted, was a most inconvenient, most unusual, and most disastrous course. The real issue was not fares. The real issue was a working arrangement between the Council and the combine. The other question of fares must grow out of that initial guarantee that the combine were going to bring their means of carrying the London public into the common stock, to work it upon a traffic agreement, and to let the fares on both sides settle down to the lowest basis that could be reached. Until the preliminary agreement, upon which everything else was based, was reached, the Council should stand where they had stood when the negotiations began.

Mr. J. M. Gattie said from the beginning the cheap mid-day fare had appealed to him as conceived on right lines and likely to develop the traffic of London. He supported the resolution of the Committee only on the understanding that the suspension was to be temporary If a better understanding were established between the parties, he believed that the traffic of London could be dealt with, not from the points of view of the opposing interests, but from that of what was the best and most economical method of transport. Thereafter this experiment could be not only re-established but enlarged, and probably adopted by those who opposed them. The public might benefit for the moment from cut-throat competition, but all the money which was wasted would have to be made up.

Mr. C. G. Ammon said what the man in the street saw in the committee's proposal was an endeavour to raise the cost of living. It was suggested that the two interests should raise the fares and share the swag, but the Labour members were not prepared to do that. If a halfpenny fare were brought in at mid-day, the Council would get an even greater influx of business. The Labour members were not prepared to play into the hands of the combine, and they wanted to run the tramways in the interests of the public. They could be no party to entering into an alliance that would add to the burdens of the public and the cost of living.

Captain G. A. Hardy mentioned that the voting of the committee was four to three against the resolution, but the chairman gave his vote, and his casting vote, for the resolution.

Mr. Squires, in replying, said the tramways should not be kept running at the cost of those who did not use them. The recommendations of the committee should be carried as a whole if the Council wanted to run the tramways in a businesslike way.

On a show of hands the motion was defeated by 34 votes to 31, and in a division, in which the chairman (Mr. J. W. Gilbert) reminded the city members that they had no vote, the figures were—For the motion, 35; against 36. The result was received with Progressive and Labour cheers, and cries of "Resign."

MINISTRY OF TRANSPORT'S POSITION.

STATEMENT BY MR. ARTHUR NEAL, M.P.

Mr. Arthur Neal, M.P., Parliamentary Secretary to the Ministry of Transport, in an interview in the *Daily Telegraph*, stated the position of the Ministry of Transport in the negotiations.

The situation, he explained, is as follows—"Municipal tramways are expressly excepted from any powers of control given to the Minister by the Transport Act of last year. Sir Eric Geddes only intervened at the express request of the London County Council to enable them to deal with what they regarded as a serious financial position arising on the workings of their tramway undertakings, at a loss estimated to be from three-quarters of a million to one million pounds per annum.

"The Council requested the Minister to arrange conferences between themselves and the management of those undertakings responsible for making due provision for travel facilities in the metropolis. The object was to see whether some working arrangement could be arrived at for the elimination of those factors which produce loss to all concerned.

"As a result of those meetings three chief points of difference were made clear, and these were summarised in Sir Francis Donnell's letter to the clerk of the County Council of August 12, as follows—

1. The amount of the initial fare to be charged at certain stages of the journey—The Underground propose that there should be a minimum initial fare of 1½d. The County Council, on the other hand, were of opinion that it would be advisable to retain a penny minimum fare in certain circumstances, and Lord Ashfield indicates his willingness to endeavour to meet the wishes of the County Council as regards omnibus fares.

2. Stage points—Agreement has not yet been arrived at between the Underground Company and the County Council as to the points between which the new fares should apply, but it was admitted there are many clearly defined points, and no difficulty was anticipated in arriving at an agreement.

3. Cheap mid-day fares—The County Council propose that cheap mid-day fares on the basis of 2d. for any length of journey should be retained, and, further, that during mid-day passengers be allowed to travel over any ordinary 2d. stage for 1d. The Underground Company strongly dissent from this suggestion, and feel that the introduction of fares of this description is wrong in principle. It was understood from Mr. Hume that, provided satisfactory arrangements were come to on points 1 and 2, he would use his best endeavours to arrive at an agreement with Lord Ashfield on this latter point.

NO PRESSURE FROM THE MINISTRY.

"It should be carefully noted that these differences were as between the management of the undertakings concerned on the one hand and the London County Council on the other hand, and that the Ministry of Transport was not putting pressure to bear on either party, but simply focussing the matters which called for further discussion and agreement. It was upon the third of these questions that the discussion in the London County Council took place, viz., the continuance of the twopenny through journey mid-day fare. This question is regarded by the Ministry of Transport as one essentially for the decision of the County Council itself. The experiment is an interesting one, and the Ministry do not propose to offer any criticism on the position arrived at by the Council at its meeting. Sir Eric Geddes is naturally anxious to secure the maximum amount of public service at the minimum charge to the passenger, consistent with the financial stability, which is an essential condition of permanent satisfactory results. With these ends in view he has, in pursuance of the recent Act, acceded to the request of the London County Council to increase their fares, and he is charged with the duty of supervising the actual fares to be charged on the Underground railways by virtue of the private Act obtained before Parliament adjourned.

"It is his desire that these new fares shall come into operation at the earliest possible date, and thus bring to an end the subsidy paid out of the Exchequer by virtue of the much-discussed agreements which were arrived at in 1914 when the Metropolitan District Railway became controlled, and in 1915, when the Act for the pooling of the resources of the Underground railways and the London General Omnibus Company received Parliamentary sanction, the effect of which has been that a very substantial sum has been paid to the last-named company.

"It is hoped that the decision of the London County Council (added Mr. Neal) will not delay this object being speedily attained. The resumption of the conferences is not precluded by the action taken by the Council."

MOTOR OMNIBUS SERVICE AT RHONDDA.—The Rhondda Tramways Company on August 9 inaugurated a motor omnibus service between Tonypandy and Clydach Valley, through a mining district extending about two miles up the mountain side from Tonypandy.

PROPOSED PLYMOUTH EXTENSION.—The Plymouth Corporation Tramways Committee have received a petition signed by a large number of residents in the Crownhill district, asking for a reliable motor-omnibus service between Crownhill and Plymouth at an early date. At present the committee have no power to go outside the borough, but they decided provisionally to plan a route from the Compton terminus to Crownhill, with through bookings to cover the journey by car and omnibus.

LIVERPOOL-PRESCOT DIRECT SERVICE.—There is a possibility that Liverpool Corporation will soon be able to run their cars direct to Prescot instead of stopping at Brook Bridge as at present. Negotiations between the Liverpool and the St. Helens Corporations have been in progress for the leasing to the former of the tramway track between Brook Bridge and Moss Street, Prescot, and it is understood that the St. Helens Corporation have approved the granting of a lease under certain conditions.

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FINANCIAL REPORTS AND MEETINGS.

MANSFIELD AND DISTRICT TRAMWAYS.—Directors have declared an interim dividend of 3 per cent. (7 1-5d. per share), less tax, on ordinary for half-year. Last year dividend same.

DEFICIT AT NEWPORT.—The general manager of the Newport Corporation Tramways (Mr. N. J. Young) reports that the deficit on the undertaking for the three months ended June 30, 1920, taking permanent way renewals into consideration, was approximately £3,900.

CHESTER CORPORATION TRAMWAYS.—The accounts of the Chester Corporation Tramways for the year ended March 25 last show an income of £24,283 15s. 6d., compared with £20,506 in 1918-19, the average income per car-mile being 21·06d. The working expenditure amounted to £17,220 14s. 10d., compared with £12,034, the average cost per car-mile being 14·93d. The amount carried to net revenue account was £7,063, compared with £8,457 in the preceding year.

WEST HAM TRAMWAYS.—The report of the West Ham Borough Tramways for the year ended March 31, 1920, shows that after deducting the allowance to men on active service, there was a gross surplus on working of £29,651. The expenditure amounted to £253,692, an increase of £38,674 over the previous year, while the income amounted to £283,344, an increase of £45,857. Provision had, however, to be made for the repayment of mortgage loans, contributions to sinking fund and interest, amounting to £31,215, and special expenditure in connection with reconstruction of £44,265, thus leaving a deficit of £44,776, which was met by a balance brought forward from last year of £7,739 and a contribution from the rates of £37,037. In 1918 the deficiency, after including all allowances for men on active service, was £28,177, and in 1919 £7,703. In 1919-20 receipts per car-mile were 21·3d., and the expenses 19·06d., leaving a balance of 2·24d. The capital outlay on the undertaking to date amounts to £556,208.

TYNESIDE TRAMWAYS AND TRAMROADS COMPANY.—Presiding at the half-yearly meeting of the Tyneside Tramways and Tramroad Company on August 10, Dr. T. J. Merz said that while there had been an increase of £4,500 in traffic receipts, the expenses had increased by over £8,000, and they had drawn upon their permanent reserve to the amount of £3,000. Although the reserve fund stood at £40,900, they had available only £29,000, because they had used the reserve for capital purposes. They must take the necessary steps to bring up the capital investment reserve fund to the higher figure. This they could do by issuing the amount of loan capital they were entitled to offer. A new issue of bonds would be made in the near future bearing interest at 5½ per cent., free of income-tax. It was impossible to say what the permanent effect of the recent increase in fares would be. He thought the increase in railway fares might be of some benefit to their company. A dividend of 5 per cent. per annum, less income-tax, was declared.

LEEDS CITY TRAMWAYS.—In accordance with the instructions of the Leeds City Tramway Committee, the general manager (Mr. J. B. Hamilton) has issued a statement showing the total revenue and total costs of operation covering the period from July 1 to 28, 1920. The traffic and sundry revenue amounted to £78,958, and the expenditure to £83,376, leaving a deficit of £4,418. There was a decrease in the number of tickets issued of 3 per cent. For the corresponding period a year ago the receipts were £66,957, the increase for the present year being £12,001. The results of operation from April 1 to July 28, 1920, are as follows—

Per Car-mile.			Corresponding period, 1919.
23·04d.	Traffic and sundry revenue ...	£320,620	£297,672
24·99d.	Expenditure	347,745	——
1·95d.	Deficit	£27,125	(Av. per day £228).

HUDDERSFIELD CORPORATION TRAMWAYS.—The report of the Huddersfield Corporation Tramways for the year ended March 31, 1920, shows that the total revenue amounted to £261,146, and the working expenses to £217,710, leaving a gross balance of £43,436. Deducting interest on capital, £8,806, and income-tax, £11,303, and including bank interest, £2,427, there is a net balance of £25,754. Including the amount brought from last year of £7,050, there is an available sum of £32,804, and this sum has been appropriated as follows—Repayment of loans and sinking fund, £10,944; renewals fund, £14,810, contribution in aid of rates, £7,050. From the statistical information given in the report it appears that the total capital invested in the undertaking amounts to £474,371. The percentage of working expenses to receipts is 83·29. The average total revenue per car-mile is 22·58d., and the working expenses per car-mile 18·83d. The average traffic revenue per mile of track is £4,512. The average units per car-mile were 1·92, and the cost for power 3·09d. The undertaking has 120 cars, and of these 95 are in daily use, the average mileage per car per day being 81. The total car mileage was 2,816,746, including 8,952 miles run by coal trucks. The average fare charged per mile was ·91d., and the average fare paid per passenger 1·74d.

LEEDS CITY TRAMWAYS.—In his annual report for the year ended March 31, 1920, the general manager states that the receipts amounted to £876,526, an increase of £153,492, or 21·23 per cent. over those of the previous year. The earnings per car-mile were 21·286d., as compared with 18·954d. This increase is partly attributable to the advance in fares which took effect on June 10, 1918, but the main cause is the greater number of passengers carried during the year. Owing to the improvement in the supply of material it was found possible to place 20 more cars in service during the year, and the number of passengers carried exceeded those of the previous year by 16,314,061, or 13 per cent. Mr. Hamilton points out, however, that the increase in receipts should be considered in conjunction with the constantly advancing working expenses. These amounted to £606,347, an increase of £184,937, and the increase in working expenses exceeded the increase in revenue by £31,445. The average expenses per car-mile works out at 14·725d. as against 11·047d. in the previous year, while the percentage of working expenses rose from 58·28 per cent. to 69·17 per cent. The principal cause of the large increase in expenses was the advance in wages. An additional number of employees was engaged during the year, and the wages bill aggregated £406,285, an increase of £133,187, or 48·7 per cent. The expenditure on general repairs and maintenance showed an increase of £58,733. Permanent way repairs have cost £28,199 more than in the previous year. The extra cost under the heading of cars amounted to £22,708.

LINCOLN CORPORATION TRAMWAYS.—The report of Mr. Stanley Clegg, city electrical and tramway engineer, for the year ended March 31 last, states that 2,712,489 passengers were carried, the ordinary passengers having increased by 5·45 per cent., and the workmen traffic by ·8 per cent. The increased expenditure during the year was on the following scale—Traffic, from £3,381 to £4,471; repairs and maintenance, £2,620 to £4,144; management and general, £1,175 to £1,812; power, £1,102 to £1,458. The total working expenses are thus increased by £3,607, of which £1,593 is represented by increase in wages (or 30 per cent.), £1,128 by increase in cost of materials (or 60 per cent.), £356 in power expenses, and £530 in rating and taxation (or 108 per cent.). The accounts reported upon by Mr. J. H. Burgess, city accountant, show a gross profit on the year's working of £2,891, compared with £5,806 in the previous year. Deducting the service of debt charges (£2,600), and including bank interest, there was a net profit of £313, compared with £3,236 last year. An advance of 5s. per week in wages, plus 12½ per cent., was given from the beginning of December last, and the year's accounts had borne the charge for one-third of the year only. The current year's accounts would bear the charge for the whole of the year, in addition to which a further advance of 5s. per week was given in March, and 1s. more in June. Fares would have to be increased to place the undertaking on a paying basis.

MANCHESTER TRAMWAYS POSITION.—At a meeting of the tramways committee on August 24, at which Alderman Bowes, chairman, presided, the report of the general manager, Mr. J. M. McElroy, on the financial position of the undertaking, was adopted. The general effect of the manager's recommendations is a reduction in the length of the 1d. stage by a quarter of a mile. Should the Council endorse the committee's recommendation, the new fares will come into operation at the beginning of October. The annual estimates prepared in April last show that after making provision for the necessary payment to the renewals fund and the payment of the sum fixed by the City Council as a contribution towards the rates, there would be a deficiency for the year of £353,530. Subsequently the general manager recommended that in order to meet the estimated deficiency the fares should be increased as to so provide for a charge of 1d. for 1¼ miles, but the Committee decided that the distance should be 1½ miles for the 1d. fare. This decision was subsequently ratified by the City Council, and the revised fares became effective on July 4 last. In the report first alluded to the general manager states that the net financial result for the year with the present fares is estimated as follows—Amount required for City Fund, £115,260; provision for renewals, £246,600; total, £361,860. Including an amount of £56,009 available, the figures show a deficiency for the year of £305,851. The estimate is based on the expenditure as at present known. The general manager says that there has been throughout the year a continual increase in working costs, mainly due to advances in the wages bill. These advances since January 1, 1920, have aggregated a sum of £200,000 per annum. It is pointed out that the longer the delay in adopting a scale of fares sufficient to produce the necessary revenue the greater the ultimate increase in fares must be, because losses are accumulating. The general manager remarks that with wages and other costs at their present level the new fares should provide the necessary revenue if continued in force for a full year.

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EDINBURGH MUNICIPAL TRAMWAYS.

THE TRANSITION PERIOD.

Mr. R. S. Pilcher, general manager of the Edinburgh Corporation Tramways, has presented his report for the period ended May 15, 1920. This is his first report, and it covers a period of only ten-and-a-half months of working, as the Corporation took over the operation of the tramway undertaking at midnight on June 30, 1919. Mr. Pilcher sees no reason why the undertaking should not become as efficient and remunerative as systems in other cities. What is required to bring this about he considers to be a progressive policy, the application of business methods to what is a commercial department, and a healthy public interest in the working of the undertaking. The local traffic conditions are favourable; but the Corporation had taken over the working at a difficult time and is saddled with a worn-out cable installation. Delivery of material has been slow and uncertain, while the price of all commodities has been steadily rising. Mr. Pilcher thinks the cable system has probably suffered more than other forms of traction in these respects owing to the large quantities of iron and steel which are required. During the five years of war very little repair work could be done, and the equipment of cars, plant and buildings received only such repairs as were absolutely necessary. As the end of the company's lease approached the cars were literally falling to pieces, and every department was in need of reorganisation. Much work has been done in bringing the undertaking to a more efficient state, but this has entailed an abnormal expenditure in every department. More cars, however, have been run, with increased mileage.

The total revenue for the period covered by the report was £506,566, against £417,490 received by the tramway company in the corresponding period, thus showing an increase of £89,076. The increase in passengers carried was 2,440,009, and the increase in mileage was 607,348. The working expenses aggregated £435,886. As illustrating the increasing expenditure it may be noted that while the pre-war cost of steel cables was £18,600, the present cost is £54,000, and the cost of pulley grease has risen from £416 pre-war to £1,274. The average weekly wage bill, which in July, 1919, was £5,005, has increased to £6,170. After deducting all working expenses there was a balance of only £65,801 to meet interest and sinking fund charges, and there was consequently a deficiency of £21,690 on the working for the period, less a profit of £1,482 earned on the motor omnibuses, to be carried forward. As fares have since been raised it is thought that an optimistic view may be taken of the future of the system.

The following statistical information is taken from the report—Total length of track, 48½ miles; cars in stock, 200 cable and four electric; cars in daily use, 180; traffic revenue per car-mile, 21·02d.; per single mile of track £10,160; total revenue per car-mile, 21·23d.; working expenses per car-mile, 18·41d.; percentage of working expenses to income, 86·88; average car miles per car per day, 115; average speed, 7 miles per hour; average car hours per day, 16½.

BUSINESS NOTICES.

THE ELECTRICAL APPARATUS EXPORT CORPORATION (Lincoln process welding and rail bonding), of New York, have opened permanent offices at 408-409, Bank Chambers, High Holborn, London, W.C., with the object of coming into direct communication with tramway undertakings in this country. The welding apparatus of the company is now being used by such representative systems as the Belfast City Tramways, the Dublin United Tramways, and Glasgow Corporation Tramways, and orders have been placed by the Dundee, Broughty Ferry, and District Tramways Company and Edinburgh, Liverpool, Halifax, and Oldham Corporation Tramways. The company's welding apparatus has been successfully used in the United States for a number of years, and also by tramway undertakings in South America, Cuba, Japan, the Phillipine Islands, and other countries. It is proposed to carry a complete line of spare and welding parts at the London depot, and to organise a staff of welding experts to assist customers in their welding problems. Mr. J. A. Campbell is in charge of the London office.

THE SIMPLEX CONDUITS, LIMITED, owing to the increase in their business in the Midland district, have opened a sales office at 41, Church Street, Birmingham, which is in charge of Messrs. Underwood and Westwood, who have represented the company in the district for many years.

NOISY MOTOR CARS.—A circular has been issued by the Commissioner of the Metropolitan Police drawing the attention of motor vehicle manufacturers throughout the country to the importance of efficiently silencing the exhaust of motor vehicles and inviting their co-operation in carrying out the provisions of the Motor Cars Use and Construction Amendment Order. It is stated to be the intention of the Commissioners to enforce the provisions of the Order.

VICTORIAN RAILWAYS' CHAIRMAN.

APPOINTMENT OF MR. H. W. CLAPP.

Mr. Harold W. Clapp has been appointed by the Government to the position of chairman of Victorian Railways Commissioners. The following brief sketch of his career is given by the *Victorian Railways Institute Review*—

Mr. Clapp was born on May 7, 1875, and was educated at the Melbourne Grammar School, whence he passed to the Brighton Grammar School. Leaving the latter when he was about 17, he commenced practical engineering work as an apprentice with the Otis Engineering Company. After being with that firm for about two years, and as he desired to see something of electrical work, he obtained a few months' leave to go to Brisbane, where the electric tramway system was in process of construction, a few lines being then in operation. Mr. Badger, manager of the Brisbane Tramway Company, seeing that Mr. Clapp was keen to learn, took a personal interest in him, and gave him every facility to acquaint himself with all branches of electric tramway work. The result was that he did not return to the Otis Company, but remained in Brisbane for several years. In 1900, on Mr. Badger's advice, he went to America, and entered the General Electric Company's works at Schenectady. While there he was mostly engaged in railway work, and was sent out by the company to superintend the carrying out of several important contracts, among them the electrification of the New York subway and elevated railways. He was associated with the New York Central Railway, principally in electrification work. The General Electric Company subsequently sent him to Philadelphia to take charge of the electrification of the West Jersey and Seashore Division of the Pennsylvania Railway.

In 1908 he left the service of the General Electric Company, and took a position with the Southern Pacific Railway Company as assistant to the chief electrical engineer. During the time he was with this company he had entire charge of all the engineering details connected with the electrification of the suburban railways of Oakland, Alameda, and Berkeley.

In 1913 he joined the E. W. Clark Company, of Philadelphia. This is a banking company having large railway interests, both steam and electric, in various parts of the United States of America. He remained with this company, managing different properties for them, until his appointment as chairman to the Victorian Railway Commissioners.

PERSONAL.

Mr. C. Johnson has been appointed rolling stock superintendent of Sheffield Corporation Tramways.

Mr. D. McCowan has been appointed chairman of the Great Yarmouth Tramways Committee for the remainder of the year.

Mr. H. E. Cordell has been appointed superintendent of the Hyde Road car works of Manchester Corporation, at a salary of £500 per annum, plus bonus allowances.

The Right Hon. G. H. Roberts, M.P., has joined the board of Messrs. Scholey and Company, Limited, electrical and mechanical engineers, 56, Victoria Street, London, S.W.

Mr. Frank Ayton, general manager and electrical engineer of Ipswich Corporation tramways and electricity supply, has been granted an increase in salary from £850 to £1,000.

Mr. C. I. Baker, tramways traffic superintendent, and **Mr. F. Field,** tramways engineer of Blackpool Corporation, have been granted increases in salary from £400 to £500 respectively.

Mr. T. R. Sykes, general manager of Rotherham Corporation tramways, has been granted an increase in salary from £500 to £700 with two annual increments of £100 to a maximum of £900.

Mr. S. L. Pearce, chief engineer and general manager of the Manchester Corporation electricity department, has entered into a seven years' agreement with the Corporation at a salary of £2,500, plus £1,000 per annum for special services in connection with the £2,000,000 Barton power-station scheme.

Mr. Frank C. Wilson, chairman of the Liverpool Corporation Tramways Committee, sailed for Canada on August 25 on the Canadian Pacific liner "Empress of France." Although making this visit to the Dominions for pleasure, Mr. Wilson proposes to take the opportunity of familiarising himself with tramway systems in Canada during a two months' tour.

Mr. J. Wallace Green, for six years secretary of the Dudley and Stourbridge Branch of the Amalgamated Association of Tramway and Vehicle Workers, and now an organiser at Birmingham of the United Vehicle Workers' Union, was presented at a tramwaymen's dinner at Brierley Hill with a half-hunter gold watch as an acknowledgment of his services as a trade union official.

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Mr. J. Burton Moss, engineer and surveyor to the Poulton-le-Fylde Urban District Council, and formerly senior engineering assistant to the Borough engineer of Blackpool, has resigned his appointment in order to take up an important position on the staff of Messrs. C. P. Sandberg, consulting engineers, Westminster, in connection with their "In-situ" rail hardening process. During the war Mr. Moss served with the forces in France and held the rank of captain in the Liverpool Regiment.

Mr. Lewis Nixon, Public Service Commissioner for the State of New York, spent some weeks in London and Paris inspecting the condition of transport in both capitals. Mr. Nixon's official position gives him supervisory powers over electric lines, surface and subway services, electric light and power, besides the gas and steam supply of Greater New York. After graduating from the U.S. Naval Academy at Annapolis, Mr. Nixon was sent to the Royal Naval College at Greenwich for further professional training, so that he is not a stranger to this country. In conversation with a London newspaper representative, Mr. Nixon said, "I have a great admiration for your system, but you have developed on totally different lines from those we follow. Your streets are so narrow that well-organised omnibus routes are probably the only efficient method of carrying people and allowing for the rest of the traffic. We prefer our tramways, because we have more room."

We regret to record the death of **Mr. Henry B. Sayers,** second son of Mr. Henry M. Sayers, who died at his father's house in Streatham, on August 23, in his 29th year. Deceased had recently been on the staff of Alloy Welding Processes, Limited.

TRAMWAY AND LIGHT RAILWAY NOTES.

BIRMINGHAM.

STATIONARY TRAMCARS.

The Birmingham Watch Committee have instructed the Town Clerk to take the necessary steps to introduce a bye-law prohibiting vehicles from passing a stationary tramcar while passengers are boarding or alighting from it.

BRADFORD.

TRAMWAYS COMMITTEE PROSECUTES DRIVER FOR EXCESSIVE SPEED.

The Bradford Corporation Tramways Committee prosecuted one of their own servants at the City Police Court, when Albert Railton, driver, was ordered to pay £1 for having driven to the public danger. It appeared that a motor backed out of a side street into the tramcar, and a man who was sitting on the back of the motor had his legs badly crushed. Witnesses for the prosecution put the speed of the car as between ten and twelve miles an hour. Two passengers, giving evidence for the driver, said that the lorry shot out of the street into the car.

BURNLEY.

SHOP ASSISTANTS' TICKETS.

Burnley Tramways Committee now issue special discount tickets to shop assistants for use within the limits of the prescribed closing hours.

COLCHESTER.

PRAISE FOR THE STAFF.

A woman resident in Colchester has recently presented to a tramway inspector a sum of money to be distributed among the conductors, motormen, and inspectors on the Corporation tramways "for their kindness and civility to her when using the cars."

DUNDEE.

FARES TO GO UP—LOOP LINES.

There was an excess of expenditure over receipts on the Dundee Corporation Tramways for the year ending May last of £8,000. At the end of the current financial year it is estimated that the deficit will be £20,000. Of the alternatives, increasing the fares or curtailing the service, the former method is favoured. Compared with other undertakings, Dundee can make the advance quite easily. The penny fare has so far undergone no alteration. The sidings in High Street, Dundee, are reported to be improving the efficiency of the service, and the tramways committee are to receive a report on the advisability of installing a similar siding at Albert Square.

EDINBURGH.

THE TRAMWAYS BILL.

Notwithstanding the recommital by the House of Commons of the Edinburgh Boundaries Extension and Tramways Bill, the supporters of the Bill secured its return to the Parliamentary Order Paper, with the result that the third reading was given to the measure. The Bill was brought forward again by direction of the Chairman of Ways and Means. The Bill has now to go before the House of Lords, and the indications point to it being passed.

GLASGOW.

EXTENSIONS—TRAFFIC CONGESTION—CELLULOID TOKENS.

The sub-committee on extensions of the Glasgow Corporation Tramways have resumed consideration of the various authorised extensions. They have agreed to continue the work on the extension from Netherlee to Clarkston as soon as the necessary material can be obtained, and they have instructed the general manager to confer with the County Council of Lanark regarding proposals for extensions from Baillieston to Coatbridge. The suggestion that the tramway department should institute a motor omnibus service between their tramway terminus at Netherlee to Eaglesham has also been deferred to the manager. The committee propose to consider the congestion of vehicular traffic. With the increased fares there has been a considerable decrease in the number of tramway passengers, and it is possible that some cars may be withdrawn; but this will have little effect on the density of traffic in the streets. The public are not yet in possession of the celluloid tokens, which are to take the place of the paper variety for the two-stage fare at present in force on the tramways. It may be recalled that it was intended to start with the celluloids, but the manufacturers could not produce a sufficient quantity of the little red discs in time. The feeling now is, says the *Glasgow Herald*, that the paper receipt—which is printed in neat blocks—will be more acceptable to patrons, as they are easier handled and lighter to carry than a pocketful of coin substitutes.

GRAVESEND.

ALLEGED NOISY TRAMCARS.

The Gravesend Corporation and the Northfleet District Council is urging upon the Gravesend and Northfleet Tramway Company that in the interests of property owners and residents along the route of the tramway they should "abate the nuisance caused by noisy tramcars." One Councillor declared that in the Northfleet Council Chamber councillors can hardly hear themselves speak, a deprivation that has evoked profound mutual sympathy. In Gravesend there has been complaints from the churches along the route.

GREENOCK.

TRAMWAYS PURCHASE.

The committee of the Greenock Corporation appointed to negotiate with the Greenock and Port Glasgow Tramways Company for the purchase of the undertaking has declined the offer made by the company. The Corporation will probably give the tramways company notice that they will take over the system within the Corporation boundary in May, 1921, when arrangements will be made with the neighbouring boroughs in regard to the two ends of the line.

IPSWICH.

A RECORD WEEK.

For the week ended August 7, Ipswich Corporation Tramways report record receipts. The total amounted to £1,491, and the average receipts per car-mile were 25·19d. This was an increase of £100 over the corresponding week last year, which was the previous best week in the history of the undertaking.

KIRKCALDY.

CARS STOPPED BY RAIN.

At Kirkcaldy on August 10, rain fell very heavily for about half an hour, and several thoroughfares were flooded, the tramway traffic being stopped on certain routes for some time.

LEICESTER.

PROPOSED TRAMWAY AND OMNIBUS EXTENSIONS — FINE FOR DRIVING THROUGH QUEUE.

The Leicester Corporation have decided to insert clauses in the next local Bill promoted in Parliament giving powers to the Corporation (1) to run omnibuses; (2) to construct a tramway from the car shed via Abbey Park Road and Blackbird Lane to Woodgate; (3) to run trailer cars; (4) to authorise increased fares for special and race cars. Leicester justices have announced that they are determined to try and put a stop to a very dangerous practice which has caused a good deal of trouble. Since the erection of the tramway queues, several drivers of vehicles and motors have been guilty of driving through queues of people leaving the pavements to board tramcars. One van driver has been fined £2 for committing the offence in Gallowtree Gate, one of the main thoroughfares.

LIVERPOOL.

TRAMWAYS LOSING MONEY—HEAVY COSTS OF REPAIRS.

Mr. Frank Wilson, chairman of the tramways committee of the Liverpool Corporation, stated at the meeting of the City Council on July 29 that the undertaking was a losing concern. The city engineer's estimate for work to be done this year in repairing the track and carrying out the Pierhead scheme amounted, he explained, to £318,000, while the amount to the credit of the renewal and depreciation account was only £282,000, showing a deficit of £36,900. The operating cost of the tramways to-day was 99½ per cent. of the revenue, and if further increases took place in wages

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and material, the expenditure would be considerably more than the revenue, and the needs of the renewal and depreciation fund, which were equal to 1s. on the rates, would still have to be met.

MIDDLESEX.

THE FARE QUESTION.

Mr. C. E. Brown, a member of the Middlesex County Council, who challenged the right of the Metropolitan Electric Tramways Company to raise fares before the special meeting of the Council in June, again raised the question at the meeting of the Council on July 29. Mr. Charles Pinkham, M.P., chairman of the Highways Committee, said the consent of the Ministry of Transport to the raising of the fares was sufficient for six months—the fixed time. The question of a permanent increase was to be considered later, and a conference of local authorities had been convened to consider if it should be opposed or not.

MORECAMBE.

MOTOR OMNIBUSES TO SUPERSEDE HORSE TRAMCARS.

Morecambe Corporation Tramways Committee have recommended the substitution of motor omnibuses for the horse tramcars which run along the front. The Council have approved the report, and the estimated cost of eight vehicles and the road making is £46,000.

OLDHAM.

RECORD TRAFFIC RECEIPTS.

The receipts of the Oldham Corporation Tramways for the week ended August 8, which amounted to £5,272, an increase of £463 over the corresponding week of last year, form a record in the history of the undertaking.

PLYMOUTH.

CAR CONSTRUCTION.

Members of the Plymouth Corporation on July 28 were taken for a trial run in the tramcar which has been rebuilt in the Corporation workshops. The tramcar is the first built in Plymouth, and is said to be the largest of its gauge in the United Kingdom. Mr. H. P. Stokes (the tramways manager and engineer), in showing the members of the Corporation over the Compton sheds, directed attention to the rebuilt car, which has been brought completely up to date after several years' disuse. The new car was constructed at the Milehouse Works. The seats are deep and comfortable, giving accommodation for twelve passengers each side. They have been carried back, however, so that, although the Plymouth cars are narrow gauge (3 ft. 6 in.), the inside width of the car is the same as the standard gauge of 4 ft. 8½ in. A dozen passengers can stand inside with ease. It is on the top deck that the greatest improvement has been introduced, the car being made capable of carrying fourteen more passengers than others, this giving the car a greater capacity than any narrow gauge tramcar in the country. By slightly reducing the gangway, double seats have been placed throughout, except on both sides of the trolley post. The curved seats over the canopy at each end enable the car to reach its maximum carrying capacity. The truck has two 45 H.P. motors.

RAWTENSTALL.

NEW CARS.

The Rawtenstall Tramways Committee are seeking the sanction of the Ministry of Transport in order to borrow £30,000 for the purchase of new tramcars, £11,750 for the erection of a tramway shed, and £2,690 for track expenditure.

SOUTHPORT.

A PROTEST AGAINST RELIEF FROM RATES.

The Southport Tramways Committee have passed a resolution protesting against the allocation of £2,100 tramways profits towards the relief of the rates. The protest is made "in view of the deficit of £6,000 created in the years 1910-14." The report for the past year shows traffic receipts £57,409, against £52,804 in 1919; working expenses £46,349, against £33,143; and gross profit £21,707 against £20,347. The mileage increased from 723,874 to 814,646, and notwithstanding the increased fares the number of passengers had substantially increased.

ST. HELENS.

INCREASED FARES.

The Ministry of Transport has issued an interim order authorising the St. Helens Corporation to charge 1½d. per mile provided this charge does not increase the pre-war fares more than 100 per cent. On the main route, therefore, from Ashton-in-Makerfield, where the St. Helens Tramways connect with the lines of the Lancashire United Tramways Company and the Wigan Corporation cars to Brook Bridge, Prescot, where connection is made with the Liverpool Corporation Tramways system, passengers pay a total fare of 1s., against the pre-war figure of 7d. The distance covered by this fare is ten miles. Passengers not travelling further than three miles pay the full fare of 1½d. per mile. The new fare came into force on Sunday, July 25, and there has been no decrease in the number of passengers carried, while the increase in receipts has been substantial.

STIRLING.

REMOVAL OF TRAMWAY LINES.

Progress is being made with the removal of the tramway rails between St. Ninians and Stirling. The conditions under which the work is being carried out were reported to the Stirling Town Council on August 16. The tramways company are lifting and removing the rails at their own expense, filling in and restoring the track with the material taken out, and where the street is causewayed, relaying the old blocks and grouting them with sand, the company paying to the Town Council the sum of £500 and the Town Council taking over the track as the restoration proceeds and freeing and relieving the company of all liability.

TEES-SIDE.

TRAMWAY ARBITRATION AWARD.

The arbitrator's award on the acquisition of the tramway undertaking by the Middlesbrough, Stockton and Thornaby Corporations has been presented. The total amount of purchase money to be paid by the three Corporations is £390,455 14s. 1d., in addition to which there is also an amount to be paid for stores as valued at the date of the transfer. The arbitrator also directs that the Corporations should pay to the company the cost of the reference and the cost of the award. The total sum expended by the company on capital account was £282,948. The company will thus reimburse the whole of this capital expenditure, and in addition will receive £107,507. The total claim presented by the company was £563,340, whilst the figure put forward by the Corporations as being the proper value was £281,766, a difference of £281,574.

WIGAN.

TRAMWAY CONDUCTOR'S FRAUD.

A fine of £5 was imposed by the Wigan magistrates on Thomas Wilding, conductor on the Wigan Corporation Tramways, for stealing tram tickets and selling them on the cars. The tickets, 100 in number, were sent down in the reserve box for the day. Defendant took the tickets from the box, and, instead of selling those issued to him, sold the stolen ones and pocketed the money. In entering up his waybill for the journeys, defendant put down the numbers of the stolen tickets he sold, but before handing the box in at the office he erased those numbers. The waybill showed that only four 4½d. tickets were sold by defendant during the whole of the time he was on duty, whereas the usual number sold during that time was between 40 and 50. Also when the defendant "cashed in," his ringer, or punch, should show the same totals as his waybills, but in the present case the punch showed an over-ring of 52 on the waybill.

CONTRACTS AND ORDERS.

The English Electric Company, Limited, are to supply additional plant of 5,000 K.W. capacity to the Hong Kong Electric Company.

The English Electric Company are constructing three double-deck tramcar bodies for Wolverhampton tramways. The contract price is £6,462.

The British Thompson-Houston Company have an order for sixteen 249A motors at £5,076 from Wolverhampton Corporation Tramways.

The Brush Electrical Engineering Company's tender for eight single-deck cars at £14,784 has been accepted by Wolverhampton Corporation.

Clough, Smith and Company, Limited, of 36, Victoria Street, London, S.W., have been awarded the contract for the overhead equipment and underground and overhead feeders in connection with the Aberdare Council's tramways extensions.

Sandberg's "In-Situ" Rail Hardening Process.—Scholey and Company, Limited, 56, Victoria Street, Westminster, have obtained repeat orders from the Bolton and Bristol tramways, and a new order from the Bury tramways for the treatment in all of five miles of track by the "In-situ" process. Up to date Messrs. Scholey and Company have obtained orders for the treatment of 100 miles of track on the undermentioned undertakings—Birmingham, Bolton, Bristol, Bournemouth, Bury, Croydon, Derby, Edinburgh, Glasgow, Leeds, Liverpool, London County Council, London Metropolitan, London United, Manchester, Newcastle, Reading, South Shields, and Sheffield.

The Glasgow Rail Contract.—Glasgow Corporation Tramways Committee have reaffirmed their decision to order from the United States Steel Products Company 10,000 tons of Lorain steel rails. It may be recalled that at a previous meeting of the City Council the matter was sent back for further consideration, it being held that the proposal was not in order unless an assurance had been received from the firm guaranteeing trade union wages and conditions for labour employed in the manufacture of the rails. The agent for the firm has written to the effect that the labour conditions were satisfactory, and that the contract for the rails had been arranged by the management after consultation with members of the committee.

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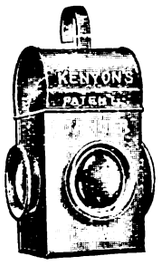

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PATENT LIST

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Automatic electric indicator for motor vehicles (23,249)—T. W. Bennett.
Air-brake systems (23,006)—British Thomson-Houston Company (*General Electric Company*).
Motor vehicles (22,893)—E. Butler and F. Fogden.
Motor vehicles (23,227)—H. Clayton and B. B. Whitaker.
Life-guards for motor vehicles (23,033)—J. W. Collen, A. J. Rolfe, and W. J. Turner.
Guard for motor vehicles (23,027)—A. E. Guppy.
Trolley wheels for tramcars (23,170)—W. J. Harding.
Lifting jacks (23,054)—W. D. Hickey.
Electric vehicle controllers (23,181)—G. L. Meyfarth.
Motor vehicles (23,229)—E. Mines.
Lifting jacks (23,209)—G. H. Morris.
Trolley heads for electric vehicles (23,309)—G. H. Donovan.
Means for greasing tramway rails (23,593)—M. Wertheim.
Means of indicating direction of cars (24,027)—T. Abbott.
Tramways, omnibuses, etc. (24,051).—C. B. Cooper.
Life-guards for vehicles (24,045)—A. T. Edwards.
Collapsible omnibus cover (24,040)—J. Golman and W. H. Loosely.
Life-guards for vehicles (23,954)—L. Grose.
Mechanical lift for motor vehicles, etc. (24,005)—A. H. M. Harding.
Tram rail (23,918)—E. Haynes.
Current collecting trolley (24,046)—J. Jassaud.
Apron for outside seats of motor omnibuses (24,041)—C. R. Lown.
Steering wheels for motor vehicles (24,359)—N. Tailby.
Electrically-driven motor wheels for automobiles (24,593)—G. A. Bishop and R. A. Chadwick.
Car trucks (24,672)—S. B. Brilhart.
Splash guard for motor vehicles (24,684)—H. Buxton.
Electric signalling for railways (24,841)—L. de M. G. Ferreira and Siemens Brothers and Company.
Fuel consumption indicators for motor vehicles (24,763)—H. Fletcher.
Motor vehicles (24,639)—S. Hope, P. C. Philipson and W. Philipson.
Safety devices for motor vehicles (24,863)—B. T. Lang.
Lighting and starting set for motor vehicles (24,433)—D. S. C. Macaskie.
Motor vehicle life-guards (24,666)—G. H. Mendel and C. H. Pullen.
Motor vehicles (24,934)—E. M. Munro.
Electric vehicles (24,741)—A. C. Nobbs.
Suspension of chassis, bodies or frames of motor vehicles (24,807)—J. Parker.

SPECIFICATIONS PUBLISHED.

1919.

Direction indicators for motor cars, etc. (9,158—*146,616*)—M. A. de C. Wetherell and B. C. E. Parker.
Omnibuses (9,377—*146,634*)—C. Dodson.
Driving mechanism for mechanically-propelled vehicles (10,863—*146,668*)—W. Mason.
Self-propelled vehicles (15,262—*146,705*)—G. H. Welford.
Electro-magnetic brake for tramway vehicles (17,243—*146,722*)—E. Bazley.
Method of attachment and springing of the road wheels of motor vehicles (9,674—*147,275*)—J. Dixon.
Change-speed gear mechanism for motor road vehicles (14,252—*147,330*)—W. H. Tate and J. H. Hooley.
Lifting jacks (21,907—*147,369*)—Lake and Elliott, A. E. Lake and A. D. Powell.
Gear changing device for mechanically-propelled vehicles (14,079—*148,029*)—H. J. Andrews.
Radiator shield for motor vehicles (17,921—*148,044*)—E. A. Evers.
Steering wheels for motor vehicles (20,350—*148,055*)—E. Sellman and E. Crosse.

1920.

Lifting jacks (6,861—*146,801*)—W. S. Wilkins.

CORPORATION OF LIVERPOOL.

TRAMWAYS DEPARTMENT.

ELECTRIC TRAMCARS AND CAR BODIES.

The Tramways Committee have for disposal and are prepared to receive tenders for the purchase of 15 (fifteen) electric tramcars, single-truck, double-deck, uncovered tops complete, and for six similar car bodies only.

Full particulars can be obtained on application to the General Manager, Corporation Tramways, 24, Hatton Garden, Liverpool.

G. HAMMOND ETHERTON,
Town Clerk.

Liverpool,
August 4, 1920.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1919. WEEKS ENDED					1920. WEEKS ENDED.					AGGREGATE.		
	Aug. 9	Aug. 16	Aug. 23	Aug. 30		Aug. 7	Aug. 14	Aug. 21	Aug. 28		Wks.	1920.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
Aberdeen Corporation	3,747	3,851	3,931	3,464	...	4,640	4,517	4,375	4,023	...	12¾	53,200	+ 8,554
Ayr Corporation	1,051	1,056	1,104	941	...	1,198	1,376	1,026	1,072	...	15	15,258	+ 869
Barrow Corporation	831	930	...	...	...	1,007	1,036	...	...	...	19	17,050	+ 1,114
Belfast City Tramways	10,827	11,063	10,309	10,178	...	11,704	11,376	11,853	11,591	...	22	255,857	+ 29,347
Birkenhead Corporation	2,853	3,366	3,276	3,039	...	3,891	3,589	3,516	3,564	...	21¼	74,665	+ 12,498
Birmingham Corporation	24,878	24,961	25,549	25,568	...	31,226	32,095	33,169	33,418	...	22	634,165	+ 72,541
Birmingham Motor 'Buses	2,306	1,911	1,787	1,656	...	2,509	2,059	2,096	2,074	...	22	44,500	+ 5,673
Blackburn Corporation	2,132	2,490	2,478	2,320	...	2,915	2,870	2,942	2,890	...	21⅝	41,488	+ 4,772
Bradford Corporation	12,315	12,381	11,914	10,977	...	13,684	12,787	12,424	12,271	...	22	270,778	+ 18,556
Burnley Corporation	3,313	3,205	3,114	3,049	...	3,862	3,821	3,111	3,187	...	—	—	—
Burton-on-Trent Corporation ...	613	548	550	545	...	713	639	619	635	...	22	12,770	+ 1,748
Bury Corporation	2,560	2,654	2,497	2,311	...	2,792	2,768	2,815	2,876	...	21¼	57,611	+ 3,945
Chatham and District	2,086	1,912	1,855	1,768	...	2,360	2,115	2,048	1,955	...	34	58,262	+ 6,235
Cork Electric	880	856	913	878	...	780	738	756	743	...	34	28,063	+ 5,209
Derby Corporation	2,206	2,066	2,124	2,079	...	2,774	2,496	2,399	2,367	...	22	49,261	+ 6,726
Dundee City	2,516	2,664	2,704	2,692	...	2,701	2,621	2,729	3,248	...	14¼	41,248	+ 3,331
East Ham Corporation	2,129	1,940	1,900	1,820	...	2,184	2,160	2,146	2,070	...	21⅝	41,883	+ 447
Edinburgh Corporation	11,643	11,527	10,660	10,529	...	12,910	12,100	11,173	10,486	...	15	191,609	+ 6,875
Edinburgh Motor 'Buses	...	...	...	...	...	1,024	991	871	926	...	15	12,520	—
Glasgow Corporation	33,388	32,146	32,375	32,068	...	42,916	43,434	44,275	38,904	...	12⅝	538,467	+ 135,034
Glossop (Urban Elec. Supply Co.)...	236	246	214	229	...	281	264	255	205	...	35	7,893	+ 127
Huddersfield Corporation	5,284	5,518	5,205	4,902	...	6,025	5,677	5,573	5,529	...	22	107,698	− 1,122
Ilford U.D. Council	1,443	1,317	1,275	1,225	...	1,492	1,389	1,390	1,321	...	21⅜	27,780	+ 1,415
Ipswich Corporation	1,391	1,189	1,111	1,074	...	1,491	1,222	1,188	1,135	...	20	22,494	+ 1,643
Isle of Thanet...	2,814	2,787	2,725	2,722	...	3,556	3,407	3,399	3,083	...	47¼	52,477	+ 12,254
Kilmarnock Corporation	243	279	278	294	...	332	357	252	342	...	15	5,521	+ 1,051
Lanarkshire	4,044	4,181	4,235	4,150	...	4,140	4,352	4,423	4,677	...	34	142,637	+ 20,735
Leeds City	...	...	...	...	...	...	...	...	...	...	—	—	—
Leicester Corporation	6,297	6,034	6,136	6,110	...	6,820	6,756	7,002	6,902	...	—	—	—
Leyton U.D. Council	3,666	3,295	3,184	2,997	...	3,286	3,112	3,216	3,013	...	22	67,676	− 2,263
Liverpool Corporation	6,506	24,753	23,870	23,052	...	31,016	28,726	27,990	28,446	...	34½	940,235	+ 192,583
London County Council	87,195	81,034	79,407	78,154	...	86,287	84,461	88,180	83,751	...	21	1,782,547	+ 71,651
Maidstone Corporation	527	441	440	411	...	632	547	535	511	...	21¼	10,693	+ 2,122
Manchester Corporation	30,315	31,549	31,406	29,991	...	36,918	35,447	35,963	36,543	...	22	673,166	+ 12,385
Newcastle-on-Tyne Corporation ...	9,419	9,328	9,424	9,261	...	11,370	10,864	10,873	11,141	...	21	236,845	+ 26,577
Nottingham Corporation	7,907	7,543	7,422	7,304	...	8,981	7,868	7,866	7,710	...	21	166,007	+ 10,064
Oldham Corporation	4,809	4,789	5,069	4,041	...	5,272	5,097	5,239	4,713	...	23	105,598	+ 3,400
Reading Corporation	1,892	1,760	1,728	1,684	...	1,878	1,727	1,738	1,677	...	21	36,063	+ 1,261
Reading Motor 'Buses	...	...	...	...	...	377	341	312	290	...	21	5,613	—
Rotherham Corporation	2,032	2,044	1,951	2,042	...	3,121	2,849	2,863	2,847	...	21	56,427	+ 10,010
St. Helens Corporation	...	...	...	...	...	2,864	2,368	2,363	2,277	...	21	43,989	—
Sheffield Corporation...	18,508	17,539	17,281	16,675	...	23,297	21,116	21,736	21,544	...	22½	471,434	+ 89,432
Southampton Corporation	3,221	3,027	2,897	2,902	...	4,090	3,791	1,844	*996	...	21	65,471	+ 5,273
Southampton Motor 'Buses	146	123	106	114	...	283	144	124	*66	...	21	4,729	+ 4,240
Southend Corporation	4,326	4,322	4,006	3,796	...	4,612	4,195	4,266	3,742	...	21	58,710	+ 5,590
South Shields Corporation	1,724	1,678	1,632	1,524	...	2,300	2,202	2,188	2,170	...	22	42,383	+ 11,489
Sunderland Corporation	3,616	3,453	3,197	3,012	...	3,883	3,556	3,256	3,317	...	22	68,648	+ 3,296
Swindon Corporation	...	504	439	428	...	488	472	464	416	...	21	8,309	+ 292
Tyneside Tramways and Tramroads	1,477	1,458	1,441	1,273	...	1,717	1,529	1,560	1,404	...	8	10,834	+ 225
Wallasey Corporation	3,044	3,427	3,068	2,710	...	3,783	3,064	2,901	2,892	...	21⅝	58,569	− 412
Walsall Corporation	1,644	1,353	1,459	1,389	...	2,199	1,752	1,897	1,793	...	22	38,275	+ 7,505
Walsall Motor 'Buses	673	501	556	514	...	1,893	1,228	1,346	1,285	...	22	23,428	+ 12,200
Walthamstow U.D. Council ...	2,192	1,917	1,819	1,688	...	2,401	2,355	2,305	2,186	...	21⅝	46,308	+ 7,383
Warrington Corporation	955	878	914	904	...	1,116	997	979	990	...	21	20,978	+ 2,277
West Ham Corporation	5,751	5,325	5,184	5,075	...	5,631	5,502	5,606	5,408	...	21¼	115,560	− 1,855
Wolverhampton Corporation ...	2,343	2,072	2,207	2,055	...	2,917	2,431	2,648	2,412	...	21	51,858	+ 9,044

* Results affected by strike.

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1919. WEEKS ENDED.					1920. WEEKS ENDED					AGGREGATE.		
	Aug. 9	Aug. 16	Aug. 23	Aug. 30		Aug. 7	Aug. 14	Aug. 21	Aug. 28		Wks.	1920.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	64,345	63,051	60,410	62,019	...	76,114	79,233	76,245	76,949	...	34	2,554,193	+ 646,414
Calcutta ... ... Rs.	88,403	90,207	87,601	88,329	...	90,044	95,931	96,401	97,283	...	34½	3,197,821	+ 262,177
Madras... ... ... Rs.	(2 weeks)	46,273	(2 weeks)	49,505	...	(2 weeks)	51,568	(2 weeks)	56,458	...	33	789,979	+ 141,717
Pernambuco	5,546	774*	3,028	5,047	...	5,927	5,817	5,769	5,657	...	34¼	241,233	+ 64,824

* Results affected by Strike.

Companies issuing Monthly Statements only.

	1919.						1920.						Wks.	AGGREGATE.	
	Mar.	April	May	June	July	Aug.	Mar.	April	May	June	July	Aug.		1919-20.	+ or −.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	3,623	4,291	3,266	3,261	...	...	4,182	4,933	3,672	3,671	...	...	12	12,276	+ 1,456
Brazilian Trac. Mlrs	9330,000	9208,000	9562,000	9369,000	10,070,000	...	9900 000	10245000	10985000	10874000	11745000	...	30	72,785,000	+ 8,752,000
Brisbane	39,380	38,775	...	...	41,610	42,245	45,460	44,890	...	...	53,300	46,650	35	367,590	+ 63,190
British Columbia $	649,120	631,988	628,847	411,605	...	...	761,182	749,081	720,004	710,210	...	...	52	8,737,132	+ 1,674,573
Buenos Ayres L'c'z.	47,370	43,605	47,319	61,356	45,222	46,846	55,000	53,429	54,563	50,635	51,508	53,952	9	105,460	+ 13,392
Burma	38,440	36,814	38,900	41,516	44,050	...	45,117	44,673	46,785	50,471	52,289	...	52	551,957	+ 101,506
Cape Town ...	...	22,564	23,405	...	12,792	...	25,089	25,010	24,395	...	23,711	...	—	—	—
Carthagena & H. ...	2,400	1,786	3,226	3,373	4,183	2,991	3,493	5,482	5,313	5,562	4,164	3,721	35	36,491	+ 12,526
Cordoba	...	...	...	17,168	18,308	...	...	...	...	20,056	20,197	...	17	79,795	+ 10,192
East India ...	2,016	1,920	2,131	2,323	2,687	2,761	3,592	3,916	3,980	3,862	4,081	4,109	4	4,109	+ 1,348
Kalgoorlie	2,653	2,907	2,796	...	...	...	3,142	3,246	3,276	...	...	...	22	14,914	+ 1,718
La Plata	6,592	5,631	...	...	5,317	...	6,392	6,142	...	...	5,353	...	31	38,497	− 1,276
Lima	50,716	49,980	42,974	47,855	...	...	60,325	57,415	54,969	55,919	...	...	26	343,173	+ 60,167
Manila ... $	207,876	212,205	202,449	160,714	...	...	263,690	254,102	280,145	267,169	...	...	26	1,621,994	+ 395,488
Monte Video ...	...	...	37,382	34,750	34,039	34,873	...	...	42,401	39,989	39,647	42,771	43	429,706	+ 60,757
Para	26,022	25,342	24,503	24,647	24,659	...	24,883	24,771	25,842	25,403	24,254	...	35	198,174	+ 1,438
Peruvian ... $	1199,420	...	1059,150	...	...	...	1302,820	...	1287.070	...	...	...	—	13274,884	+ 1.966.779
Port Elizabeth ...	...	5,576	5,145	...	3,247	...	7,214	6,381	6,165	...	...	6,106	—	—	—
Rangoon	7,533	6,217	6,533	6,276	...	...	8,698	7,857	7,933	7,849	...	...	26	47,471	+ 8,845
Toronto ... $	1083,285	1051,960	1032,717	842,697	...	...	1255,668	1211,708	1206,930	1127,239	...	...	26	7,045,748	+ 912,452
Winnipeg ... $	384,937	367,196	248,191	112,615	...	...	456,915	431,685	404,742	407,625	...	...	26	2,644,677	+ 770,037

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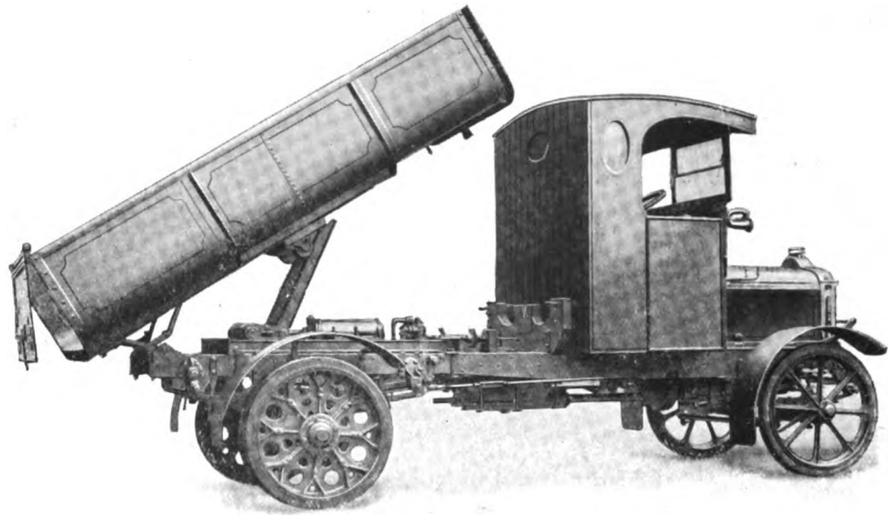
Daimler

This vehicle can be examined on **STAND 73** at the Commercial Vehicle Exhibition OLYMPIA 14-23 Oct. 1920



The continuous and profitable service that a Daimler gives is due to the wonderful efficiency of the Daimler sleeve-valve engine

Bodies fitted to Daimler chassis include—

Omnibuses, Chars-a-bancs, Municipal types, and Utility bodies for the requirements of every trade. With end-tipping bodies, hydraulic tipping gear is fitted. Where pneumatic tyres are ordered a mechanical air pump can be supplied and fitted to both type chassis.

The Daimler Company Ltd. Coventry

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REGD.

AEC

COMMERCIAL MOTOR VEHICLES

An A.E.C. 30-h.p. "K" Type Saloon Omnibus, Passenger Capacity 37, will be on Exhibition at the First Dutch Roads Congress, The Hague, September 15th-26th. Stands 6 and 9.

A.E.C. "K" TYPE CHASSIS

This Chassis is specially designed as an economical and efficient vehicle, particularly suitable for passenger carrying. The arrangement of the driver's position at the side of, instead of behind the engine, increases length of loading platform by 3' 6" without adding to the overall length of the chassis. The design also allows a more even distribution of load on the axles and reduces the body overhang behind the rear axle. This feature, in conjunction with the specially designed springs, provides an exceptionally comfortable riding vehicle.

FURTHER PARTICULARS AND COMPLETE SPECIFICATION ON APPLICATION.

A.E.C. "K" Type Double Deck Omnibus, seating capacity, 46

NOTICE.
Will owners of A.E.C. Vehicles not purchased direct from the Company or from its Agents, communicate with us, giving Chassis Nos.
Inspectors will call from time to time to assist and advise them on economical working. Our help and advice is free.
Drivers Instruction Books for A.E.C. (Y.B. & Y.C.) type Chassis, free on application. Please quote Chassis Nos.

Write for Catalogues of Passenger & Goods Vehicles

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Telegrams: "Vangastow, Waltstreet, London."

BUILDERS OF LONDON'S BUSES

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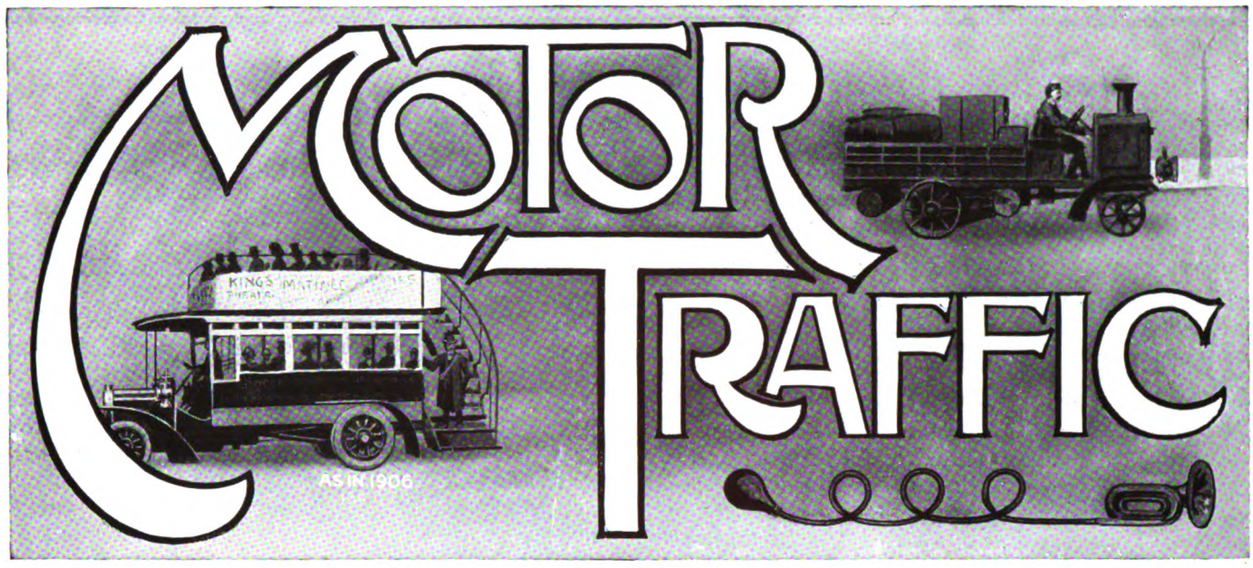

THE COMING EXHIBITIONS.

Everyone interested in the various uses of motor vehicles should certainly make a point of visiting London during late October and early November. The exhibition of commercial vehicles will be open to the public from October 15 to October 23, and it will be followed by an exhibition of private cars, with only sufficient interval between to permit of the removal and staging of the exhibits. For the first time the private car exhibition will be divided into two separate buildings, at Olympia and the White City respectively. No doubt the former section will, partly from force of popular habit, prove the main attraction to the public. The division of the exhibits is an unfortunate necessity. Olympia is no longer large enough for the purpose, and so the present regrettable state of affairs must apparently continue unless the experiment of running a sort of overflow exhibition proves so unsuccessful that its repetition cannot be considered. In any case one can hardly expect such immense crowds of visitors as were seen at Olympia last year. In mechanical matters it is questionable whether there will be many startling innovations. On the whole, one may expect to see less obvious signs of the influence of aero engine production on car design. Probably one of the most significant of the comparatively new developments is to be found in electro-magnetic transmission. This undoubtedly gives very smooth starting and acceleration. The efficiency at high speeds should be good. The transmission is not unduly heavy, and though the cost is probably somewhat higher than that of a normal design, the system probably has a great future in connection with high-class cars in which the question of cost is not the first consideration. The more straightforward forms of petrol-electric vehicle are, of course, already well established, particularly in the sphere of the public service and goods carrying motor. Another development which will no doubt attract much attention is the flexible form of six-wheeler to which we referred last month.

CLEARING HOUSE DEVELOPMENTS.

After a long period of incubation, the establishment and proper organisation of road transport clearing houses seems now to be coming along fairly rapidly. It is, of course, perfectly obvious that, without such clearing houses, we cannot solve the return load problem. It is equally obvious that so long as clearing houses are merely of local significance, are isolated from one another, and are not sufficiently numerous to form a complete system, their utility must be immensely curtailed. Consequently the formation of an Association of Road Transport Clearing Houses is to be welcomed as an important step in the right direction, as also is the organisation of large numbers of agents to act as clearing house officials in the interests of the industrial vehicle membership of the Automobile Association. As to the first of these two developments, the new Central Association is formed for the co-ordination, advancement, and consideration of road transport and questions connected with it, and particularly for the purpose of linking up the various existing and embryo organisations in the various trading centres so that the whole shall proceed in accordance with the general plan and complete co-operation will be secured. The scheme must, of course, involve the establishment of properly staffed clearing houses where they do not already exist, and much discussion on the question of rates, so that the somewhat vague ideas on this point at present current can be crystallised into something approaching a definite tariff. A Central Association of this kind may be either immensely valuable or almost completely useless, according to the efficiency and energy of its officers and staff. As yet it is too young for any considered opinion as to its practical merits to be formed, and all that can be said is that the underlying principle is undoubtedly sound.

FUEL RESEARCH BOARD'S REPORT.

The report of the Fuel Research Board on Fuels for Motor Transport, a *précis* of which appeared in our issue of August 9, is a disappointing document. The compilers of this report appear to have ignored altogether the question of the relative convenience of use of various fuels. It was unnecessary to go into details as to the obvious merits and importance of coal, but the trouble is that coal and coke are not suitable fuels for the use of vehicles of the speed and capacity required for the great bulk of trade purposes. No one has yet succeeded in constructing a practical steam vehicle, using solid fuel, to carry any load less than about three tons. We cannot overcome the inherent difficulty that these solid fuels are heavy and bulky. So also are the water supplies necessary to be used in conjunction with them. Probably steam lorries could

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MOTOR TRAFFIC.

be considerably more extensively employed in this country than they are at present, but they can never replace the majority of internal combustion vehicles and therefore we must necessarily have at our disposal a liquid fuel possessing the broad characteristics of petrol. Certain quantities of such fuel can be obtained from coal, but the quantities are limited, and are by no means adequate to a complete solution of the difficulty. The report deals at some length also with gaseous fuels derived from coal, but most practical men will be very much surprised if these ever come into general use unless they are forced upon us by a very serious shortage of liquid fuel of any kind. We need never expect to see again the huge gas-bags that were attached to a fair number of vehicles during the war. Compressed gas may conceivably be used by big concerns operating public service vehicles on fixed routes, but will never commend itself to the average trader. The report deals also with the possibilities of alcohol. Here it is pessimistic, apparently because of the results of analysing with great care the cost of producing fuel alcohol in this country. Nobody who has given this proposition much thought is in the least impressed with it. The point is, however, that if other countries, more favourably placed in respect of climate, can produce alcohol even in sufficient quantities to fill the immediate and the growing needs of their own road transport, the demand for petrol, benzole, and similar fuels will be prevented from rising so rapidly as it must otherwise do. There is no inherent difficulty in the way of using fuels based on alcohol, and there is no reason why these fuels should be excessively expensive, provided only that they are produced in sufficient quantities and under the favourable conditions obtainable in tropical countries.

PROCEEDS OF TAXATION AND ROAD IMPROVEMENT.

When the petrol tax was first introduced the underlying principle which made it more or less acceptable to the motoring community was that the whole of the proceeds should be devoted strictly to the improvement of the road system as altogether distinct from its maintenance. The general argument was that the road system is essential to the community as a whole. It is therefore the business of the community to maintain it. If, however, a particular section of the community is specially desirous of roads being much improved or rebuilt from the foundations upwards on some new system, then that section must make a special contribution towards the improvement. During the war the principle was naturally in abeyance, and for the time being the proceeds of the petrol tax went to the Exchequer. Now, with the new system of taxation, we have an altogether new principle. This is that the motoring community is called upon not merely to improve the roads for its own special advantage, but to relieve the ordinary authorities of the bulk of the expense of maintaining them. The principle is altogether unsound, and this fact has been more or less recognised by the Minister of Transport. It must, however, be steadily borne in mind by those concerned, otherwise we shall find it established as a permanent arrangement that mechanical transport, as distinct from any other form of road user, is called upon to pay the whole cost for the benefit, not of itself only, but of the entire community.

THE FORTHCOMING CONFERENCE.

No doubt these questions of principle will be discussed at the conference which will be held under the auspices of the Imperial Motor Transport Council in October. The Empire overseas is, as a whole, in far greater need of improvement of the road system than we are here. The limited extent to which motor transport is at present employed in the Dominions and Colonies is due mainly to the inadequacy of the roads. It would be unreasonable and also impossible in such countries to tax motor users so as to compel them to provide all the funds required for road improvement, so that others not yet motor users, but destined to become so in the future, would benefit at the expense of the pioneers. It should, however, be distinctly laid down by all the Governments of the Empire that the whole of the proceeds of any taxation levied on motor vehicles, directly or indirectly, should be definitely earmarked and regarded as the nucleus of a road improvement fund. For every pound so collected it would be reasonable for the Governments concerned to contribute some agreed amount on behalf of the community. If the motor owner felt that by paying one pound of tax he would get five pounds' worth of road improvement, the imposition of a tax would have a much smaller repressive effect upon road transport development.

COMMERCIAL AVIATION.

It is extremely interesting and instructive to learn that, when one of our pioneer aerial services was put under the management of an experienced organiser of road transport, the result was to turn an almost hopeless proposition into a commercial success. The pioneers of aviation are amply equipped with enthusiasm and ideas, but generally speaking they lack experience in commercial organisation of transport. Equally, aircraft manufacturers have not until recently had occasion to consider this aspect of the use of aeroplanes. They have built with a view to very high efficiency, high speeds and exceptional performance. They have not given much attention to the fact that in commercial operation every machine must do an honest day's work, or else standing charges are bound to be exceptionally high. Some sacrifice of efficiency, of speed, and even of weight carrying capacity may be necessary in order to ensure that the very thorough maintenance system required does not make the time spent in the shops altogether disproportionate to the time spent in the air. It may well happen that the experience of Mr. Searle during the early critical days of motor omnibus development may be the means of directing the energies of aircraft constructors into new lines, and of making civil aviation for the first time a really sound and paying proposition.

A NEW LONDON OMNIBUS.—The London General Omnibus Company are engaged in trials of a new omnibus which provides seats for 56 passengers, equally divided between the lower and top decks. The Commissioner of Police has agreed to license a limited number of these vehicles. With two exceptions in front, all the seats occupy transverse positions. The two types of vehicle at present in service accommodate 34 and 46 passengers respectively.

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MOTOR TRAFFIC

A NEW LIGHT-WEIGHT OMNIBUS.

In the May issue of the TRAMWAY AND RAILWAY WORLD we published the drawings of a new type of omnibus body which had been designed and patented by Mr. W. J. Hickman, together with an announcement that the General Seating Company, of 162, Grosvenor Road, London, S.W., had arranged to build these vehicles. We are now able to give photographic reproductions of the omnibus, from which it will be seen that the designer's claim to have produced a high capacity vehicle on pleasing lines has been fully substantiated. For many years Mr. Hickman has made a special study of omnibus requirements, both from the passenger and owner points of view. He has always strongly advocated improvements in design which would tend to eliminate the risk of accident due to faulty distribution of weight, body overhang, and other causes so pronounced in the earlier types of double-deck omnibus. After many years' close observation of running repairs due in a large measure to these causes, and considerable constructional experience, Mr. Hickman has now produced what in his judgment is the ideal omnibus for either town or country services.

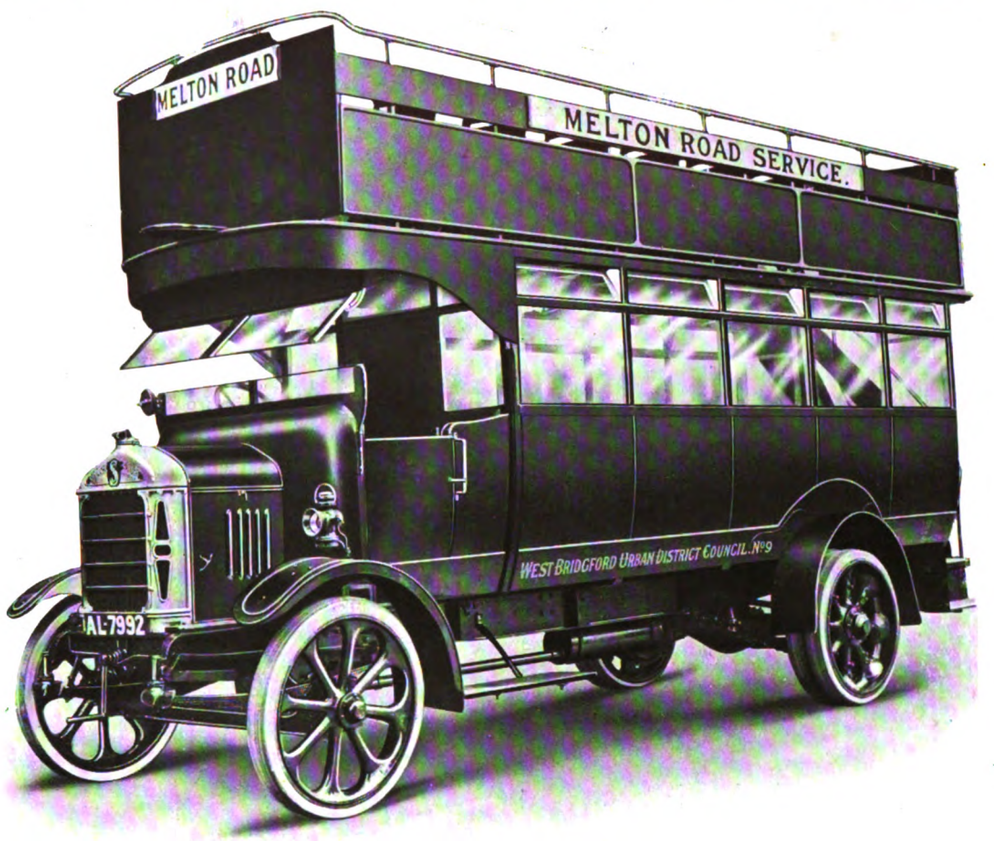

Fig. 1.—The Hickman Light-Weight Omnibus on a Straker Chassis.

Some three years ago Mr. Hickman put forward a number of general suggestions with regard to motor omnibus design. Amongst these were—

Reduction of unladened weight to reduce road shock.
The driver to be placed beside the engine.
Redistribution of weight in order to prevent whipping of chassis frame.
Greater relative number of seats in the interior of the body.
Reduction of overhang.
Reduction in height of load line.
Reduction of ground clearance, and elimination of propensity to skid.

We understand that these suggestions were discussed with the representatives of the Commissioner of the Metropolitan Police and also with the London omnibus companies, and the fact that they are now embodied in the latest type of London omnibus clearly proves their value.

With regard to body design it has been left to Mr. Hickman himself to provide the practical demonstration of his theory as to what constitutes the most satisfactory type, and this is shown in our illustrations.

Briefly stated, the advantages claimed for this type of body are, large carrying capacity, light weight, a wide margin of safety and a pleasing appearance.

There appears to be a desire steadily to increase the carrying capacity of public service vehicles without always paying due regard to what may be considered a reasonable limit. In fixing the seating capacity of his omnibus at 46, Mr. Hickman expresses the opinion that it is more desirable to provide a seating capacity which is likely to meet all normal requirements and have wide gangways to accommodate standing passengers during rush hours than to increase the number of seats to such an extent that many of them will be unoccupied during 90 per cent. of the life of the omnibus. It is obvious that the success of an omnibus service depends not merely on the number of seats provided per vehicle but rather on the number of passengers carried and the operating costs. Following this theory the design shown has a gangway in which 16 passengers could stand and yet enable the conductor to perform his all important function without any undue inconvenience.

The weight of the Hickman body as shown in the illustrations is 25 cwts. As will be seen, no sacrifice has been made in the lines of the body to bring about this reduction in weight. It is 16 feet in length and, although reduced to a mere shell, has a wide margin of strength. The exterior dimensions across the pillars is 6 ft. 2 in., while the available width inside is 5 ft. 11⅞ in. This result, together with the light total weight, is achieved by the scientific application of dry English ash, suitably trussed and jointed, the joints being reinforced by light steel castings of a patent design.

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MOTOR TRAFFIC

On the question of safety, Mr. Hickman is strongly of the opinion that omnibuses should be constructed to suit average road conditions and that it is unreasonable to expect public authorities to spend money on the removal of lighting and tramway standards to enable the existing type of omnibus to be operated. In Mr. Hickman's opinion the majority of the accidents to passengers on the top deck of omnibuses have been due partly to the excessive width of the top deck, and partly to the dropping of the vehicle on the near side springs under an excess load on the near side, accentuated by road camber. In extreme cases this overhang has been known to reach to 18 inches from the rim of the near side wheel. In the omnibus illustrated the extreme width is 6 ft. 2 in. to the outside of the pillars, while the top deck width is 5 ft. 11 in. to the outside of the guard rails. When the vehicle is standing with the near side wheels 3 inches lower than the off side, representing an excessive road camber, the top deck guard rail and the edge of the roof of the body is in a vertical line above the rims of the near side wheels, it will thus be seen that all possibility of the top deck colliding with lamp standards is entirely eliminated.

The plan for the redistribution of weight between the near and off sides is shown in the interior view (Fig. 2). It will be seen that single seats are provided on the near side and double ones on the off side, with side seats for three passengers near the entrance. The top deck provides seats arranged in a similar manner, except that the cross seats are continued throughout the entire length of the body. The net result of this seating arrangement actually places 4 cwts. more load on the off side than on the near, and in practice has been found exactly to counteract road camber. I ensures that the omnibus will not drop on the near side and is beneficial to the vehicle for 97½ per cent. of its working life. Moreover, it provides for the proper functioning of the springs, a most essential point from every consideration. The comfort of the passenger is enhanced by this method of seating, for although the

Fig. 2.—Interior of the Hickman Omnibus.

gangways are wider than is possible with the older method, the off-side seats themselves are longer, being 34 inches which, together with the turn-under of the body is equal to 35½ in. against the 32 in. standard double seat. The interior gangway width is 18 in. between the shoulders of the passengers on the cross seats when the vehicle is loaded, so that it will readily be seen that with this and the space between the side seats a large area is provided for standing passengers for peak loads. The top deck available gangway width is 15 in. and therefore provides ample space to enable passengers to move freely to and from their seats.

Fig. 1 shows the fairly big turnunder which has been included in the design of the body. The waist rail is somewhat higher than is usual. The long fixed and comparatively narrow windows reduce

Fig. 3.—Hickman Light-Weight Omnibus Showing Wide Entrance.

the appearance of height, as also does the deep front canopy bend. It will also be seen that the body is mounted free from the dash, while the canopy carries the front row of passengers of the upper deck.

Fig. 3 is a three-quarter rear view. Although the platform is of the standard London length of 36 in., it actually provides a much larger available area for the passengers and conductor, as the staircase is carried further back.

The body entrance is considerably wider than usual, there being sufficient room for two passengers to pass when mounting or leaving the vehicle. On the occasion of a recent visit to the works of The General Seating Company a representative of the TRAMWAY AND RAILWAY WORLD was given an opportunity of inspecting a number of the Hickman type bodies in course of construction as well as the finished omnibus. The excellence of workmanship, the high quality of the materials employed, and the scientific method of building up the weight-carrying sections of the framework deserve the highest praise, and we feel confident that this latest venture on the part of the General Seating Company will add considerably to the reputation they have always enjoyed.

FUTURE OF THE SLOUGH DEPOT.

Sir Percival Perry has informed the *Daily Mail* that the Slough depot consists of a number of complete industrial works. He is relinquishing part of them as fast as possible, and is willing to finance "competent individuals" who take over any portion of them for the development of any small industry. The newcomers will have a nucleus of business to start with, and preference will be given to ex-service men as far as possible.

"I am convinced," said Sir Percival, "that a vast undertaking like Slough cannot be economically managed under one head, and it is not to the benefit of the nation that it should. A big nucleus of repair work in the shape of our army contracts will be retained in shops covering 15 acres. This will leave 85 acres of fully equipped buildings that can be applied to other industries, as well as 50 acres of land with roads and railways, and 250 acres partly developed. This idea was in my mind when I purchased Slough. In five years I estimate the Slough works will be employing at least 40,000 men, as against 2,800 to-day."

Since its purchase from the Government for £7,000,000 last April the Slough works have been used exclusively for the reconditioning of British Army motor vehicles, and lately for the 13,000 vehicles purchased from the United States Liquidation Commission at the Coblence dump. In the last three months the total cash sales at Slough exceeded £2,500,000.

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MOTOR TRAFFIC

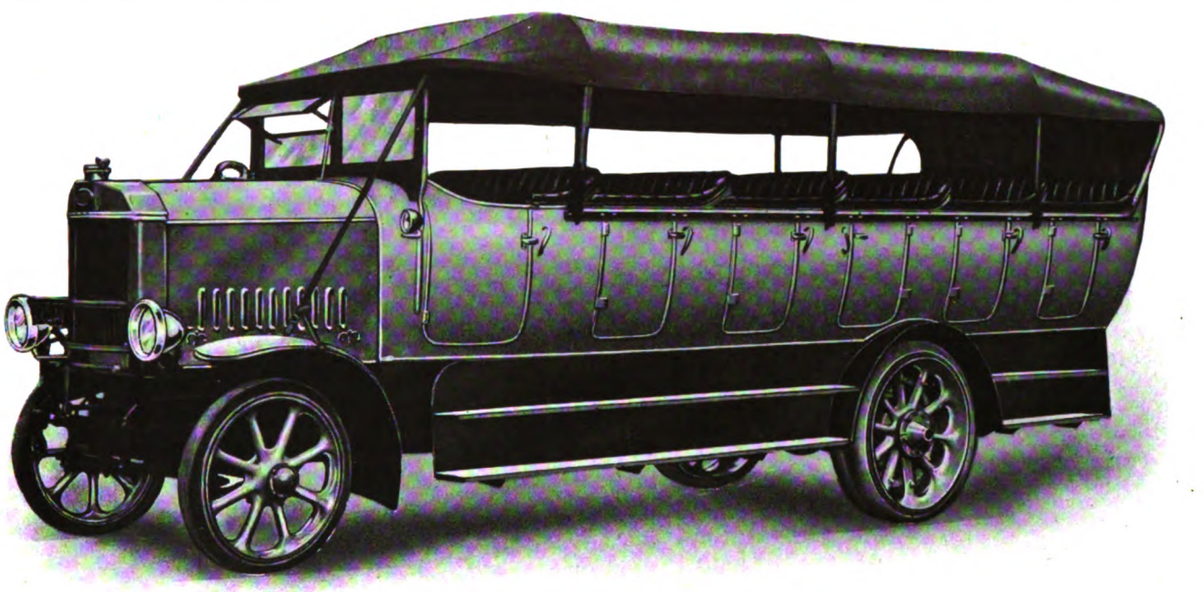
STEVENS PETROL ELECTRIC MOTOR COACH.

A 1,300 Mile Tour.

The motor coach which is illustrated on this page has recently returned from an extended tour through England and Scotland, taken as a trial run for the machine, which was fresh from the builders' hands at the commencement of the trip. The running of the vehicle was in every way satisfactory, and the following extract from a report of the run is of interest—

The route taken lay through Guildford, London, Lichfield, Chester, Liverpool, Preston, Blackpool, the English Lakes, Carlisle, Hawick, Selkirk, Galashiels, and Edinburgh, to Glasgow. Returning to Edinburgh, the journey south was via Dunbar, Berwick-on-Tweed, Alnwick, Newcastle-on-Tyne, Durham, Darlington, York, Grantham, Huntingdon, Cambridge, and London, to Guildford.

The total mileage, including detours, was 1,328, averaging over 100 miles per day, although on several occasions the start was made after lunch. The longest day's journey was from Ambleside and the Lake District to Edinburgh via Keswick, Carlisle, Gretna Green, Hawick, and Galashiels—146 miles. The roads were generally good, although bad stretches were found on the Coventry road and round Newcastle.



Stevens Petrol-Electric Motor Coach.

The trip was thoroughly enjoyable, and we are sure there exists no better way of seeing the country than by making a tour on a smooth running motor coach such as the Stevens.

The chassis is the "Stevens" standard 3-4 ton petrol-electric subsidy type, which has been described in previous issues of the Tramway and Railway World. The outstanding feature is the electric drive. The elimination of all gears and clutch not only ensures the smooth steady motion which has made the petrol-electric system so popular for passenger transportation, but the ease and certainty of the control renders it exceptionally suitable for this class of traffic. As will be seen from the illustration, a handsome vehicle has been produced as a result of the co-operation between Messrs. Stevens and James Bartle and Company, Limited, the well-known body builders, of Notting Hill. The design and finish as well as the high-class workmanship leave little to be desired either for appearance, comfort, or convenience. Seating accommodation is provided for 28 passengers. Upholstered in green leather, the seats and backs approach the comfort of the touring car, but with the additional advantage that owing to the higher elevation a much more extended view of the country is obtained. The body is finished in French grey, and as the radiator and bonnet are of aluminium a most pleasing appearance is obtained. The electric lighting of the car is effected directly from the main dynamo on the vehicle. This provides a practically unlimited supply, obviating charging when the lights are not required, the battery acting practically as a balancer. The usual head, side, and tail lights are provided. Full particulars of the "Stevens" petrol-electric vehicles can be obtained upon application to the company's office, 82, Victoria Street, S.W.1.

ELECTRIC VEHICLE PROGRESS.

The size and contents of the *Electric Vehicle*, published under the auspices of the Electric Vehicle Committee of Great Britain, are indicative of the progress which has been achieved by this traction unit in its various forms. Even by those acquainted with the rise of the battery vehicle in this country, new facts will be found in the first instalment of an article contributed by Mr. Fox, of the Edison Storage Battery Company, New Jersey, on the industry in this country. He relates how the war gave a fillip to the use of the electric, which was not impressed by the War Office. It made no difference when the drivers were conscripted, for the salesmen "rubbed home the fact that an unskilled man, a woman, or a boy could drive it." The Britisher continued to buy after the first urgent need had been satisfied, and has been buying ever since, with the result that to-day there are not enough electric vehicles on sale in the United Kingdom to supply the demand. Plans are in hand, however, to cope with this situation. There are four or five firms now manufacturing electrics of several different types, and at least one of them, recently formed, intends to produce in considerable quantities in the near future.

While the greater number of electric vehicle sales have been made to customers requiring from one to three machines, there are several large fleets in operation now or in contemplation. Thus the Midland Railway Company uses over 80 road vehicles, varying from the 15-cwt. to the 5-ton capacity; Harrods, Limited, the large drygoods merchants, have over 70 vehicles on the road; J. Lyons and Company, Limited, caterers and wholesale bakers, run about 25 vehicles; Selfridge and Company, while only having in present operation six cars, have many more on order. In addition to this there are numerous firms operating fleets of from 5 to 15 trucks.

The electric's history is to be continued in the September issue of the journal, when Mr. Fox will no doubt have something to say of the vehicle's great progress among municipal authorities during the war. In this department it has made its way on account of the shortage and high cost of labour and the cost and restriction of petrol, as well as greater suitability for the work of refuse collection and haulage of clinker. In this connection the August number contains a statement by the cleansing superintendent of the Glasgow Corporation that his committee intend to place a further order for

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MOTOR TRAFFIC

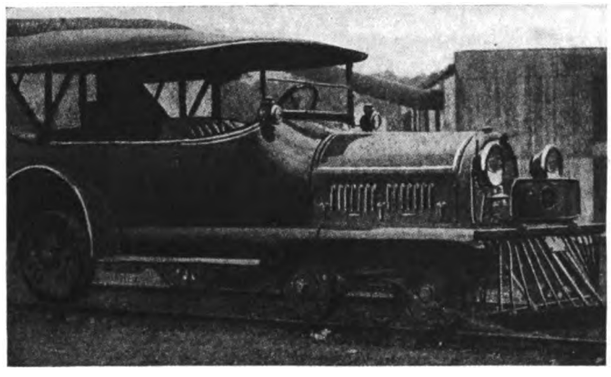
several machines. Another department in which the electric is making headway is among the Co-operative Societies. In the internal transport of factories and on railway platforms the electric truck is supreme. When manufacturers have made up the arrears on orders for commercial types, it is anticipated that the private runabout will attain popularity.

In an editorial note disappointment is expressed that the Ministry of Health have fixed the period for repayment of loans for electric vehicle purchase at only seven years, as against five years for petrol and steam machines used for the same purpose. In the opinion of the Electric Vehicle Committee, a period of ten years could safely be granted, as the rate of depreciation in the body, chassis, and driving and control gear is so slight.

MOTOR CAR FOR RAILWAYS.

The accompanying illustration, which is reproduced from the *Railway and Locomotive Engineer*, of New York, shows a motor car adapted for use on railways. It could be used profitably on non-paying roads where the traffic does not call for a frequent service of heavy steam locomotives. The car was built and patented by J. F. Kehrman, master mechanic of the Mississippi River and Bonne Terre Railway, at Bonne Terre, Mo. The general dimensions and features are as follows—

Cylinders, 6; diameter, 3¾ in. by 5 in. stroke. Total wheel-base, 10 ft. 8 in., rigid, 3 ft. Swivel truck, 4 wheels, ball-bearing centre



Motor Car Adapted for Railway Service.

plate, no arch brace, truck built with studs. Air pump attached to crank shaft, and air brakes on all wheels. Equipped with whistle signal, horn, air sanders, and air drums attached to running board, 2½ cu. ft. capacity. Also equipped with hand brake on front truck operated by steering wheel. Tires of open hearth steel flanges and taper. The car can take curves of 100 ft. radius, and is rated at 40 miles per hour on 1·80 grades. Petrol consumption is about one gallon for 20 miles.

In a trip of 63 miles over the Mississippi and Bonne Terre Railway, which portion is on an 1·8 grade with curves of 500 ft. radius, the motor carrying seven passengers, three gallons of gasolene were used. Weather tops are being applied to the cars already in service, which adds greatly to their appearance. It may be added that the car may be built with two or more propelling wheels according to the size required. The growing demand for the new service shows that it is well suited to the needs of the locality.

Cost of Goods Haulage by Road.—Deptford General Purposes Committee report that they have considered the suggestion that further pressure should be applied to the Ministry of Transport to promise a goods station at Deptford. In the reply of the Ministry it is stated that the cost of moving goods from North London by rail "would be of an expensive nature, and the charge it would be necessary to levy for such a service would probably be more than the present cartage cost." The committee understand that the cost of transit by van from Deptford to North London is 17s. a ton, and in view of this figure they are replying to the Minister enquiring whether he took into consideration this amount when stating that the cost of forwarding goods by rail would be greater than the present cartage cost.

CONCRETE ROAD FOR MANCHESTER.

Manchester Paving Committee have adopted a suggestion by Mr. Meek, the city engineer, for constructing an experimental concrete road in one of the streets of the Openshaw district. In his report Mr. Meek stated that in the centre of the city the volume of traffic carried on steel tires is so severe on the surface of the road that it causes abrasion to occur in the toughest and hardest of granite setts, and it therefore does not appear probable that concrete, however well set and hard, would successfully stand the wear of it. In residential districts Mr. Meek considers that a concrete road, properly constructed, would stand for many years, provided it had not to carry heavy traffic on steel tires. Wherever it is adopted he suggests that the surface of the concrete should be placed as low as possible and tar-sprayed, so that, should the concrete surface fail, it could be replaced with rock asphalte with the minimum amount of cutting away.

"F. W. C.," writing from London to the *Manchester Guardian*, says—"I have manufactured and laid some hundreds of miles of concrete road in America and Canada, also the first five miles of reinforced concrete road for the War Office at Chiseldon Camp, Wilts. In America, I venture to say, 70 per cent. of the cities have concrete road, kerbs, and pavements. When American engineers are talking of laying new roads they think only in concrete, because they find there is nothing to touch it for sanitation, low cost of manufacture, and maintenance.

"In the suburbs no covering is laid on the surface, which makes a delightfully clean picture, as there is little or no dust. On the surface in the main thoroughfares a 1 in. asphalte or bitumen carpet is laid, which is sufficient to save the road from exceptionally heavy traffic.

"I fail to see why the question of cutting up for drains should be raised, as in most cases the engineer makes sufficient provision for future requirements. In the case of minor alterations it is quite common to tunnel, and so avoid dislocation of traffic and cutting of concrete.

"As regards cracking, this is entirely governed by four points—

"1. Buying cement from one kiln burning.
"2. Special attention to mixing.
"3. Laying the road in short lengths.
"4. Covering with wet sand or tarpaulins.

"We have laid concrete roads in the West with a temperature of 85 deg. in the shade, and had no difficulty with cracking. I have known concrete roads, reinforced with no carpet, to last for ten years at a small average cost of 7 to 10 cents per square yard. At the end of this period a carpet has been laid, with the result that the life of the road has been prolonged a further five to six years."

OMNIBUSES WITH TRAILERS.

A fleet of six motor omnibuses and four trailers has been put in service by the Okmulgee Traction Company, of Oklahoma, to supplement its electric railway service. Okmulgee is the capital of one of the largest of the cattle growing counties of Oklahoma, and is in the centre of rich oil and coal fields. The single-deck omnibuses are to run in paved streets only, with the exception of the special service run to a park where games are played. Each of the routes is from 1½ to 2 miles from the centre of the city. The omnibuses are of the one-man, pay-as-you-enter type, with the entrance at the front. They are equipped with electric bells, lights, and heaters, and have pneumatic tires. The trailers, however, have solid tires. The car and trailer combined seat 42 persons, but their capacity is 60 persons. The fare is 5d., but three fares are given for 1s. The omnibuses are operated by gasoline, which is provided by one of the five big oil refiners in the town. It is rumoured that the company find the omnibus service so satisfactory that it contemplates abandoning the electric railway service and substituting a complete motor service.

In discussing "The Omnibus of the Future" before the Society of Automobile Engineers, Mr. Green, who some years ago went from England to become general manager of the Fifth Avenue Coach Company of New York, said a large operating company would require two types, the double-deck for large loads and the single-deck for smaller loads and faster operation. A 50 to 60 passenger low double-deck vehicle, capable of drawing a trailer, seemed to offer great possibilities, together with the single-deck, one-man controlled, pneumatic tire omnibus.

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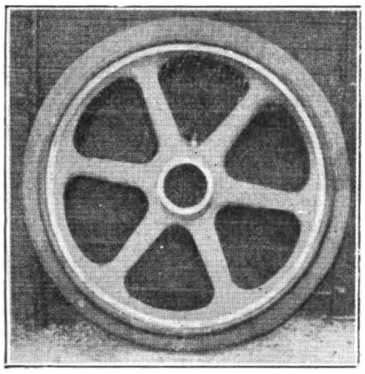
MOTOR TRAFFIC

ALUMINIUM WHEELS FOR AUTOMOBILES.*

The advantages to be gained by the reduction in the weight of an automobile as a whole are generally recognised. Another factor which has a very material bearing upon the running costs of a car is now receiving attention, namely, the ratio of the weight of the unsprung portion of the chassis to the total weight. At first glance it might appear that the unsprung weight should be substantial in order to secure adherence on the road, but further consideration shows that this is an error, and the minimum wear upon the tires is obtained when the unsprung weight is reduced as far as is practicable. When the wheels of a car pass over an uneven part of the road an upward impulse is given to the wheels and to all the unsprung portions of the car supporting the wheels. The flexibility of the springs prevents the impulse from being imparted to the sprung weight except to a very modified extent, and it is obvious that the larger the ratio between the weights of the sprung and unsprung portions the quicker the springs will be able to return the wheels to the ground.



Hollow Spoked Wheel Cast in Aluminium for Commercial Motors.

The tendency of the wheels to leave the ground and spin at any abnormal speed induced by the engine is well known, but the extent of the action is not always appreciated, and it is interesting to note in this connection the results of an actual test. A truck was driven at a speed of 15 miles per hour against a 2-inch bump in the road, and it was noticed that the wheel striking the blow left the road and, at a greatly accelerated speed travelled through the air for a total distance of 59 inches before again hitting the ground. Contact with the ground was followed by a marked slippage and excessive tire wear.

This excessive wear can be minimised by reducing the total unsprung weight, and such a reduction will also cause a smoother running of the car and increase the effectiveness of the springs. It will be appreciated that when the unsprung weight is large in comparison with the sprung weight the shock can only partially be absorbed in the springs, and the remainder will be transmitted to the body of the car. When the unsprung weight is light, however, the shock transmitted to the body is much less, since the springs will drive the wheels downward rather than drive the body up.

Disc Wheel Cast in Aluminium for Commercial Motors.

RESULTS OF TESTS.

One of the most effective means of securing a reduction in the unsprung weight is the employment of aluminium castings for the wheels. Such wheels have been adopted to a large extent principally in America, where both the six-spoked design and the disc construction are popular. A special aluminium alloy having a tensile strength of some 27,000 lb. per square inch and a specific gravity of 2·89 is employed, and it is claimed that such wheels show a material saving in weight over the more usual types. The wheels have been subjected to the most rigorous tests which demonstrate their ability to withstand fatigue. These tests were made on a number of light and heavy commercial motor vehicles, which were driven over the worst possible rural roads in the course of a series of cross-country trips extending for many months.

Both solid and pneumatic tires were used, and in no case was failure of any kind noted. No signs of metal fatigue were perceptible, and no cracks, breaks, or flaws of any kind. Moreover, an examination of the tires of these wheels showed no cracks, and the tire core was intact all the way round. On the other hand, tires on steel wheels, which were being run at the same time and under the same conditions for the purpose of comparison, showed severe wear, the surface being so worn that a smooth edge existed at each side of the face, while a number of deep lateral cracks were perceptible across the entire width.

These tests indicate clearly that the advantages of aluminium are by no means theoretical, and the saving in unsprung weight attained by the use of aluminium wheels presents a real improvement in the running characteristics of any kind of automobile.

* From a recent publication by the British Aluminium Company.

CARS WITH LEFT-HAND DRIVE.

NO EVIDENCE TO JUSTIFY RESTRICTION.

Appended are the main conclusions arrived at by the Departmental Committee on the Regulation of Road Vehicles which has considered the desirability of prohibiting or restricting the use of the left-hand drive mechanically propelled vehicles—

(1) That there is no available evidence at the present time from the point of view of public safety which would justify the prohibition or restriction of the use of these vehicles in this country, though uniformity of construction of such vehicles may for some reasons be convenient.

(2) That if practicable a uniform and simple code of signals for drivers of all vehicles, whether mechanically propelled or drawn by animals, to indicate to other traffic their driving intentions should be laid down, such signals to be given in a clear manner from a stereotyped position on the off-side of the vehicle.

The committee will not present their report until they have considered certain further questions which arose out of the inquiry.

"SAFETY FIRST."

During the first year of peace 2,628 persons were killed and 48,698 injured in street accidents in the British Isles. Since 1916 the London "Safety First" Council has waged war against this wastage of life. A reduction of 48 per cent. represents the result of its efforts, no mean result, yet one that could be greatly enhanced by the wholehearted co-operation of the public. H.R.H. the Duke of York has consented to become the president of the Council.

At the Machine Tool Trades Exhibition to be held at Olympia in September, a convention will be held under the joint auspices of the Home Office and the British Industrial "Safety First" Association. Engagements permitting, the Home Secretary will preside at the morning session and Lord Leverhulme in the afternoon. Invitations have been extended to the managements and workers of the principal industries throughout the country, to employers' federations, employees' organisations, Whitley Councils, the Federation of British Industries, and the National Union of Manufacturers; also to representatives of Government departments and numerous other personages prominent in commercial and industrial circles. The arrangements for the conference are in the hands of Mr. Gerald Bellhouse, C.B.E., deputy chief inspector of factories and workshops, and Mr. H. E. Blain, C.B.E., the operating manager of the Underground Railway and London General Omnibus Group.

PASSENGERS IN AN UNLICENSED LORRY.—At Spalding, on August 17, the Flax Cultivation Company, Limited, were summoned for carrying passengers in an unlicensed lorry, the prosecution being instituted by Holland County Council. For the defence a case was quoted in which the Divisional Court ruled that a vehicle used occasionally for conveying workpeople need not be licensed. While the flax mills were under Government control an unlicensed lorry was used for the conveyance of the workpeople. It was also pointed out that the case was one that affected farmers and fruit growers all over the district. The prosecution urged that a lorry used continuously for three months was not being used occasionally. The magistrates dismissed the summons.

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MOTOR TRAFFIC

STRAKER-SQUIRE SERVICE IN WALES.

A great addition to the conveniences of life in the Oswestry district was made during the past summer, when a Straker-Squire omnibus arrived from Edmonton to run in the "Flying Fox" motor services organised by Mr. W. Davies. The vehicle seats 48 passengers, and the lower deck has two compartments and two entrances. Unlike the Metropolis, the provincial police regulations allow the driver to be protected from the weather by a screen, while

Novel Type of Body on a Straker-Squire Omnibus.

a passenger is also permitted to sit by the side of the driver. Assistance, whether skilled or unskilled, is therefore at hand to take the wheel and manipulate the levers in the event of the driver being overtaken by illness or death. The driver's compartment being open to the front saloon for passengers, enables the latter also to go to a driver's assistance.

MOTOR TRUCKS ON FARMS.

The Firestone Tire and Rubber Company's review of current events states that a survey made in the eastern United States by the Department of Agriculture during last winter and spring would indicate that the principal advantage of the motor truck on the farm is the saving of time.

Reports of 753 farmers are included in the survey. They estimate that their average truck mileage is 3,820 miles a year, and that the trucks are used on 173 days of the year.

The average cost of operation of half-ton trucks is reported as about 8 cents a mile; three-quarter-ton trucks, 12 cents; 1¼ and 1½ ton trucks, 19 cents; 2-ton, 20 cents. Average cost of hauling crops, including driver's time at 50 cents an hour, is about 50 cents per ton with half-ton trucks, 34 cents with three-quarter-ton trucks, 26 cents with 1-ton trucks, 24 cents with 1¼ and 1½ ton trucks, and 18 cents with 2-ton trucks. About four-fifths of the farmers reporting state that their trucks reduce expense of hired help. On the average they estimate this saving amounts to 324 dollars a year.

COMMERCIAL VEHICLES OF GREAT BRITAIN.

The B. F. Goodrich Company have issued volume 2 of their publication on "Commercial Vehicles of Great Britain," a copy of which they will send to any firm interested on application being made to the head office, 117, Golden Lane, London, E.C. The first volume was found of great service to many users of commercial vehicles. Volume 2 is more comprehensive, and will probably make an even wider appeal to manufacturers, traders, and users. Articles on standard systems for recording the operating costs of commercial vehicles and lengthening the life of motor vehicles are included in the volume, and will be found particularly useful, as they deal with the pressing problem of how to secure economy. An illustration and specification is given of various types of chassis of the leading manufacturers, besides much other useful information.

SIR E. GEDDES AND ROAD TRANSPORT.

In an article contributed to a London newspaper, Sir E. Geddes, Minister of Transport, said—"It is obvious that the main line railways, although they are the framework of transportation, are neither sufficient, nor entirely suitable, to meet the growing need for movement. They must be supplemented in every direction, and some, possibly much, of their work must be taken over by road transport, and probably by light railways. The Ministry of Transport has therefore a development department costing in all rather less than the well-earned remuneration of an eminent barrister. It examines where money can be spent with profit on supplementary transport systems."

RECONDITIONED W.D. LEYLAND LORRIES.

Leyland Motors, Limited, report that their newly-acquired Ham Works are in full operation, and that already a large output of reconditioned W.D. returned "Leyland" lorries is being effected as the result. So well has progress been made in this connection that the company can offer prompt delivery of this type. The company have acquired the balance of the Leyland vehicles which the Government has decided are surplus to its peace time requirements. An opportunity is thus given to the commercial world to purchase these machines after they have been through the company's own hands and reconditioned in their own factories. Only machines which have been so treated are sold to the public with the company's guarantee. In the event of any Leyland vehicles being offered to prospective customers which have been acquired by other parties than the Leyland Company an invitation is issued for such customers to make inquiry from the Sales Records Department, Headquarters, Leyland, Lancashire, giving the chassis number of the machine so offered, when any particulars that are required with regard to that machine will be furnished, in order that it may be properly identified. Instances have been reported to the company in which second-hand Leylands have been offered by unauthorised parties as new. In the event of any such case coming to the notice of the company serious action will be taken without delay.

LEYLAND OMNIBUS AT PENZANCE.

The Leyland double-deck omnibus has invaded the hilly south-west counties. The vehicle illustrated on this page was supplied to Taylor's Garage, Limited, Penzance, by Leyland Motors, Limited.

A Leyland Omnibus in Cornwall.

The body is painted dark green, and the inside seats are upholstered in green leather. It accommodates 45 passengers, and is built on a four-ton 36-40 H.P. chassis. The county is not well provided with means of communication, and the new facilities offered in the Penzance district have been much appreciated during the past summer.

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MOTOR TRAFFIC

"B" TYPE OMNIBUS FOR SALE.

Now that the famous "B" type omnibuses are being replaced by the more roomy "K" type, the Associated Equipment Company, of Walthamstow, are offering a large fleet of the former type for sale. Each vehicle is guaranteed to have been overhauled by the London General Omnibus Company within six months of the date

"B" Type Omnibus Built by the A.E.C.

of sale, and any part proved to be defective within six months from date of purchase (other than through reasonable wear) is replaced free of charge.

The excellent way in which many of these vehicles stood up to the strenuous war work in France (many have since returned to service on the London streets) says much for the splendid quality of this vehicle. Chassis or complete omnibuses can be purchased, and everyone interested should make early enquiries.

THE RISE OF S. SMITH & SONS, LTD.

The firm of S. Smith and Sons, Limited, of the Central Works, Cricklewood, and 179-185, Great Portland Street, W1., now find it necessary to issue a house journal in order to keep the motoring public fully acquainted with their enterprise. In manufacturing and salesmanship the firm have come to the front in a manner which constitutes a romance of business. Their venture in the publishing world is entitled "Roadcraft—A Motoring Miscellany." In the course of the first article in the current issue Mr. C. W. Nichols, director, says—

"In 1914 the company, although owning or controlling a number of proprietary lines, were actually manufacturers only of speedometers and instruments. They realised that to compete successfully, not only in quality but also in price, it was necessary to manufacture these different accessories themselves. The war gave them their opportunity, and the Cricklewood factory, built in 1915 for the manufacture of munitions of war, to-day manufactures speedometers, watches, gauges, carburetters, lighting and starting systems (complete from dynamo armatures to lamps), mechanical horns, etc. To-day Smiths own and manufacture a larger number of proprietary lines than any other similar house in the world. Their list includes practically every accessory necessary for the construction of the complete car, not forgetting the M-L magneto, which has been standardised by nearly all the leading manufacturers. To-day practically every British car and lorry manufacturer include one or more Smith product in his standard equipment. When an accessory is returned for repair, providing it is of post-war design and manufacture, it will be replaced by a similar article within a few hours of receipt."

Plymouth Omnibus Scheme.—Application is to be made by Plymouth Corporation for powers to run omnibuses within a radius of fifteen miles from the borough boundaries.

A NOTABLE TIRE RECORD.

The following letter has been received by Chas. Macintosh and Company, Limited, from their South African agents, the Griffin Engineering Company, Limited, Johannesburg—We forward you under separate cover photographs which we have had taken at the express wish of Captain Dutton, the chief transport officer of the South African Railways, showing some of your old and some of your new tires side by side. The new tires we have just had pressed on after the old tires had been in continuous use for approximately five years on a Denis tractor, during which time it is estimated that they did 27,000 miles and transported over 45,000 tons, apart from nine months' use on an experimental railway system, where the front wheels of the vehicle were provided with ordinary railway wheels to enable them to run on the rails, whilst the back wheels with your tires on ran on a special concrete track outside the rails (a new system of railway transport which has been patented by Captain Dutton, and which is being taken up by the British Government). Captain Dutton believes these tires have done record work of probably any tires of the same size run anywhere in the world.

MOTOR TRAFFIC NOTES.

Motor Haulage in the U.S.A.—Last year 1,000,000,000 tons of freight were hauled by the motor trucks in the United States, as against 90,000,000 tons carried on the Great Lakes and 2,504,000,000 tons moved by the railroads.

A London All-Night Service.—On August 16 the London General Omnibus Company resumed their all-night service between Cricklewood, Willesden, and Liverpool Street Station, which had been suspended during the war.

Blackpool Coach Prosecutions.—Eighteen drivers of motor coaches were summoned at Blackpool for a breach of the Corporation by-laws which forbid the picking up of passengers in the street, the maximum penalty being £5. The bench imposed fines ranging from ten to twenty shillings.

Trade Unionists Purchasing Omnibuses.—Since June seventy employees of the East Kent Road Car Company have been on strike. The local trade unionists propose to purchase a number of omnibuses with which to start an opposition service, the profits from which will be used "to reduce fares."

Cars Standing in Piccadilly.—In view of the present traffic conditions and of the necessity for maintaining a free flow of traffic, the Commissioner of Police has informed the motor organisations that no cars (except cabs on authorised ranks) will be allowed to wait in the centre of the road in Piccadilly.

Suffolk Omnibus Services.—As soon as additional omnibuses can be obtained, the Eastern Counties Road Car Company intend to institute a number of new services. At present they operate ten services from Ipswich and Wisbeach. In readiness for the extensions several new garages are being erected.

Omnibuses for Blackpool.—On the recommendation of Mr. C. Furness, general manager of Blackpool Corporation Tramways, the tramways committee have appointed a sub-committee to consider the question of the most suitable type of omnibus, with power to invite tenders for the supply of six vehicles.

Straker-Squire Gully Emptying Machines.—The Metropolitan Borough of Deptford has placed an order with Messrs. Straker-Squire, Limited, of Edmonton, N.18, for one of the firm's standard gully emptying machines, and the Metropolitan Borough of Lambeth has placed a repeat order for a gully emptying machine.

Motor Licences in London.—From January 1 to July 31 the number of pleasure cars registered in the county of London was 15,073, against 8,761 for the whole of last year. Over 12,000 motor cycles were registered in the same period, and so far 66,816 drivers' licences (including renewals) have been issued, as compared with 61,341 in 1919.

Coach Traffic at Southend.—Southend Watch Committee have under consideration the making of an order under the Town Police Clauses Act, prescribing the routes to be observed by chars-a-bancs in the borough, and also the possibility of providing an area where such vehicles coming into the town might be parked to prevent obstruction in the streets.

Claim Against the Ministry of Transport.—East Riding County Council report that a claim has been sent into the Ministry of Transport in respect of damage caused by lorry traffic from Hull ports via the York Road, the amount being £39,907. The damage was caused as a result of the railway strike, when motors were requisitioned to get the goods from the ports.

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MOTOR TRAFFIC

KESTEVEN'S CHARGE FOR OMNIBUS TRAFFIC.—Kesteven (Lincs.) County Council have requested the Peterborough Electric Traction Company to pay 1d. per car-mile in respect of their service between Peterborough and Bourne, and will make the same charge throughout the county to owners of omnibuses plying for hire on any route not regularly used by omnibuses prior to March 1, 1916.

A MUNICIPAL TRANSPORT DEPARTMENT.—In view of the mechanical transport vehicles already purchased and now on order, Ilford surveyor has been instructed by the Urban Council to prepare a report relative to the formation of a motor transport department to control the transport work of the Council, together with a workshop for the storing, maintenance, and repair of the vehicles.

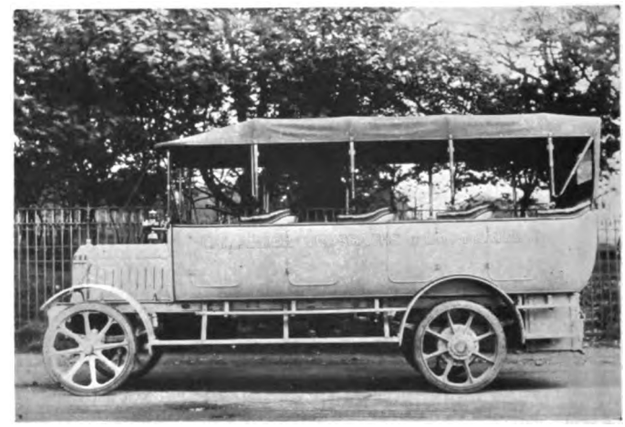
CENSUS OF LANCASHIRE MOTOR TRAFFIC.—A census of motor traffic taken by the county surveyor of Lancashire during a period of seven days between 8 a.m. and 8 p.m., shows the following result on the Blackpool main road—Cars, 8,114; cycles, 5,612; motor vans, 315; chars-a-bancs, 2,381; lorries, 879; trailers, etc., 54; total, 17,355. On the Garstang-Blackpool road the total was 3,409; the Lancaster-Preston road, 14,087; and Liverpool-Manchester Road, 6,309.

LONG JOURNEYS BY OMNIBUS.—This year some of the London newspapers have chosen a sensible "silly season" topic by discovering long distance omnibus journeys. One discovery is the well-known fact that by travelling on four linked routes a passenger can journey from London to Leicester, a distance of one hundred miles. These linked services are common in the Midlands and the North. It is also possible to go from London all over Kent, Surrey, and a considerable part of Sussex.

MOTOR TRANSPORT ABROAD.—By writing to the British Consul, Fez, manufacturers can be put into communication with the promoters of a motor transport company which is being established there. British firms are invited to communicate with the Department of Posts and Telegraphs, Calcutta, with regard to supplying motor lorries for the department. At the end of this year the department will require six 3-4 ton lorries and nine 1-ton lorries.

REFLECTOR GLASSES FOR COACHES.—Replying to a question in the House of Commons, Mr. Neil, Parliamentary Secretary to the Ministry of Transport, stated that the police had no power to make a general regulation requiring coaches to be fitted with reflector glasses, and he was not satisfied that such a provision was desirable. A regulation requiring drivers to keep close to the kerb would not be practicable. On country roads there were no kerbs, and the construction of the roads in many cases was not such as to render this desirable or even safe. Drivers of heavy vehicles were advised to keep to the left side so far as was practicable.

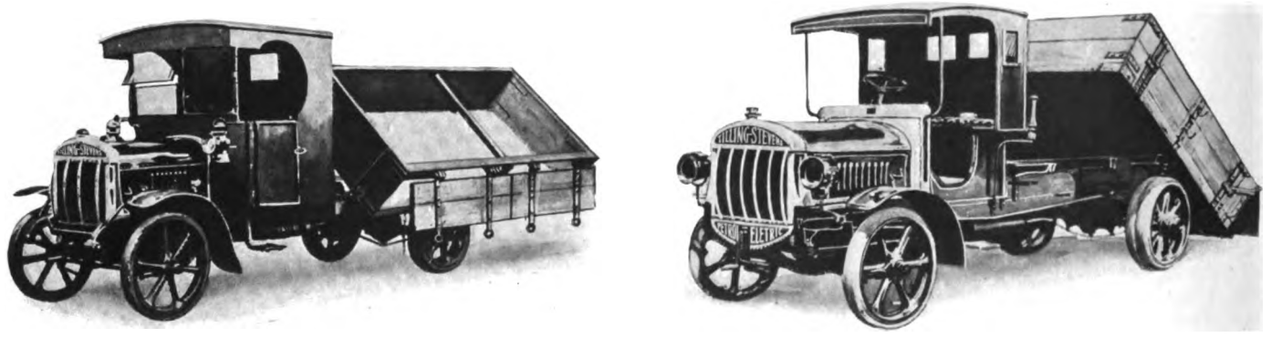
WINDOWS BROKEN BY FLYING STONES.—South Shields Corporation nave received letters from shopkeepers notifying that



Albion Fifteen-Seater Torpedo Chars-a-banc Supplied to the Trossachs Hotel Company.

windows had been broken by stones hurled from the road by the wheels of the North Eastern Railway motor omnibuses which pass along Fowler Street at great speed. There was also a letter from an assurance company pointing out that great dissatisfaction exists amongst the shopkeepers, "who are suffering from broken windows caused by stones being shot from under the wheels of the N.E.R. omnibuses." A co-operative society complained that a Corporation omnibus had broken a window in a similar manner. The Town Clerk was instructed to repudiate liability.

IPSWICH MUNICIPAL GARAGE.—For 1919-20 the revenue of the electric vehicle garage of the Ipswich Electricity Department was £659. This sum shows a reduction compared with the preceding



Tilling-Stevens 4-Ton Petrol-Electric Chassis with Tipping Body.

INNOVATION IN A RAILWAY GUIDE.—The August issue of the A.B.C. Railway Guide contains under the heading of Eastbourne an entry relating to "another route by road." This addition suggests that there is a need for publication of road motor services from and to London, and doubtless an attempt will be made next year to supply the want. Numerous provincial towns have long possessed convenient time tables issued by companies and corporations carrying on omnibus services. Particulars of motor services are also to be found in the time tables issued by railway companies.

VULCAN LORRY WITH HYDRAULIC TIPPING APPARATUS.—An interesting demonstration of a hydraulic tipping apparatus fitted to a 30-cwt. Vulcan lorry was given in Dumfries on August 21 by the Dumfries Motor Company, Limited, the local agents of the Vulcan Company. Various kinds of loads were handled where building operations were in progress, the average time taken to clear each load being 50 seconds. The Vulcan tipping device is operated by the engine, which drives two hydraulic rams. The body is raised by simply moving a single lever, and this can be done by the driver without leaving his seat. Those present were greatly impressed with the ease with which the demonstrations were carried out.

year, as no battery charging was done for Messrs. Ransomes, Sims and Jefferies' electric vehicle factory, the firm now having their own garage. The revenue does not include the sale of 50,708 units of electrical energy (supplied under the restricted hours tariff) for charging batteries. This brought in a further £434, working out at an average of 1·9d. per unit. The actual cost was not above 1·5d. per unit, giving a profit of £93. The total profit to the electric supply department from the garage business was £189, or nearly 21 per cent. There are 15 vehicles being garaged, and others are coming. The Electricity Commissioners have expressed their desire to encourage this branch of electricity supply. Ipswich Council was the first authority to be granted borrowing powers for the construction of a public electric vehicle garage.

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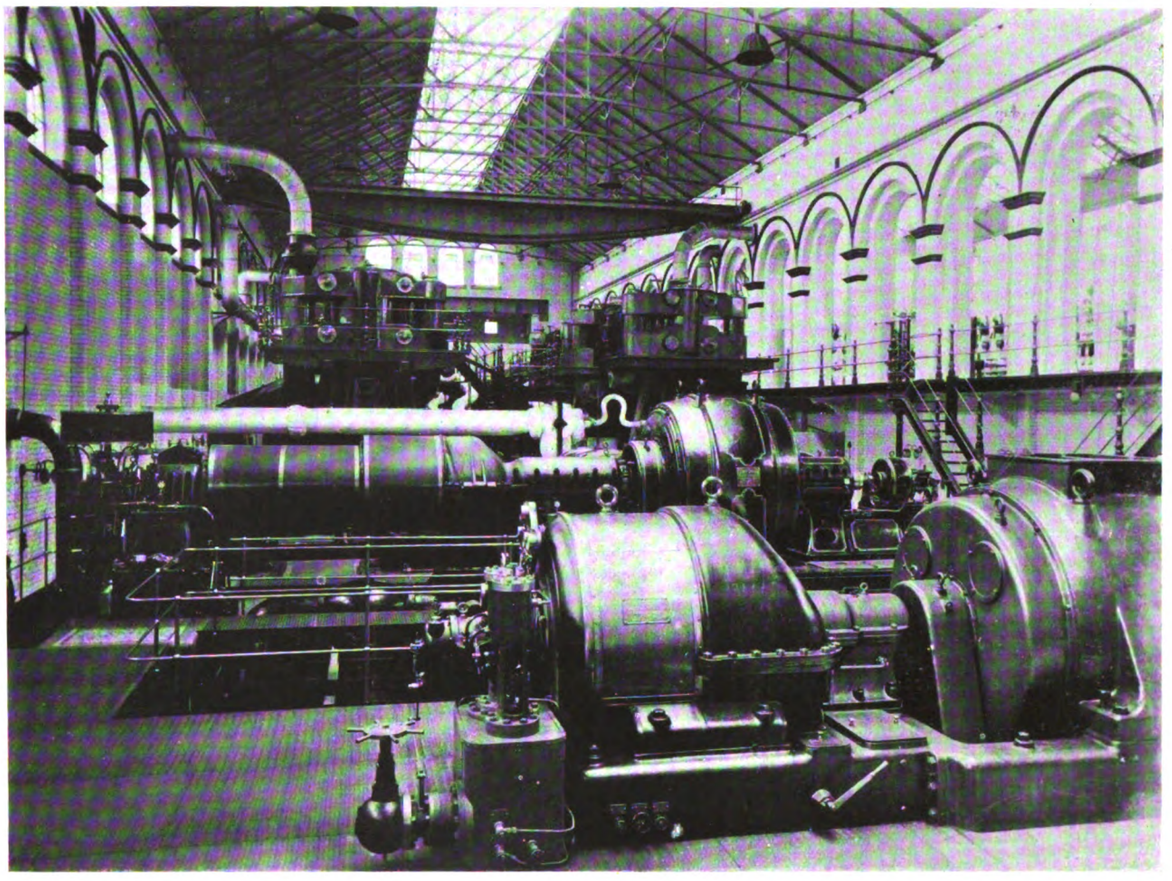
THE
Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, OCTOBER 14, 1920. VOL. XLVIII.

THE CARDIFF CORPORATION TRAMWAYS.

The city of Cardiff, where the nineteenth annual conference of the Municipal Tramways Association was recently held, is fortunate in the possession of an excellent system of electric tramways. On the occasion of their visit the members of the Association were presented with a brochure *de luxe* prepared by the City Development Officer. To this brochure Mr. R. L. Horsfield, the general manager of the tramways, to whom we are indebted for much assistance in the compilation of this article, contributed a brief review of the city's tramways. His survey opens with the justifiable statement that "few cities have such facilities for the making of delightful, health-giving journeys as Cardiff." With electrical tramway services of the highest efficiency linking up various sections of the city with the central point at the Great Western Railway Station, anyone arriving by train is enabled to reach conveniently any point he may wish to visit.

The tramways, constructed under the Cardiff Corporation Act, 1898, include the reconstructed lines originally laid down by the Provincial Tramways Company, Limited, and the Penarth Harbour and District Tramways Company, Limited, with a total length of track in operation amounting to something over 34 miles, and was partially opened for traffic on May 1, 1902, with 12 electric cars, the old horse system being gradually withdrawn as the new cars were supplied. An illustrated account of the undertaking was given in our issue of June 12, 1902; and the important work of electrification and extension of the system carried out by Mr. Arthur Ellis, then general manager and borough electrical engineer, and the late



Interior of Cardiff Corporation Power Station at Roath.

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city engineer, Mr. W. Harpur, was described in detail. The early history of the scheme may here be briefly recapitulated.

In 1898 Mr. Andrews, the then chairman, the deputy chairman, and the city engineer visited many important tramway systems in the kingdom. As the result of their report the Council decided to adopt the overhead electrical system, although the estimates placed before Parliament were based on the conduit system. In June, 1900, Mr. Arthur Ellis was appointed electrical engineer to the tramways department, and in the month of December following he became borough electrical engineer and manager of the electric lighting and tramways undertakings. These positions he retained until the beginning of this year, when he resigned in order to devote himself to consulting work.

Four sites were purchased for the power-station and car depots, viz., four acres at the eastern end of the borough; two acres and twenty-four perches adjoining the power-station site of seven acres, upon which the main car depot was erected; and a site at the western end of the borough upon which a district car depot was built.

Track construction was begun on one of the new routes in December, 1900, and negotiations with the Cardiff Tramways Company ended in their lines being handed over to the Corporation at midnight on December 31, 1901, in return for a payment of £50,000. Long discussions took place as to whether the reconstruction of the company's lines should be carried out by contract or by the Corporation works department. One firm offered to complete the task in six months, with the usual allowances for bad weather, traffic, etc., but the borough engineer undertook not only to do the work in the same period, but at a lower cost. His proposal was adopted, and the whole of the twelve miles was completed on May 16, 1902, or one month earlier than the time guaranteed.

The power-station is located at Roath, on a site of seven acres, along with the main car depot, repair shops, etc. The station, a fine substantial building, was erected by Messrs. Symonds and Company, of Cardiff. The plans for the generating station were prepared by Mr. Ellis and Mr. Harpur, and construction was started in December, 1900, the foundations going down to an average depth of 17 ft. Room was left on the far side of the engine-house for an exact duplicate of the boiler-house and coal bunkers, so that when completed the engine-room would be between two boiler-houses. The engine-room was extended in 1905. The original machinery in the engine-room comprised four engines, each of 500 H.P., and two of 1,600 H.P., supplied by J. Musgrave and Sons, Limited, of Bolton. The four original 300 KW. generators were by the British Westinghouse Company, Limited, and two of 900 KW. were subsequently obtained from Dick Kerr and Company, Limited. A 2,000 KW. Willans-Siemens turbo set was obtained in 1908; a Fraser-Chalmers-Siemens 2,000 KW. turbine set was added in 1914; and a Westinghouse 2,000 KW. turbine set in 1918. At the outset there was an 80 KW. motor generator by Bruce, Peebles and Company, Limited, which worked in conjunction with a battery of accumulators, made by the Tudor Accumulator Company. There are now two 300 KW. motor generators, and a 1,250 KW. rotary converter. All the generators, with the exception of the 2,000 KW. turbo sets, are driven by slow speed vertical cross-compound engines. In order to avoid further expenditure in buildings, two 300 KW. motor generators are to be replaced next year by a 5,000 KW. British Thomson-Houston turbo-alternator with rotary condensing plant.

The boiler-house contains 16 Lancashire boilers, fitted with Vicars' mechanical stokers and four water tube boilers, and complete coal and ash handling plant by Fraser and Chalmers, Limited. These, however,

Tramways in Queen Street, Cardiff, with Centre Poles Supporting Trolley Wires and Electric Lamps.

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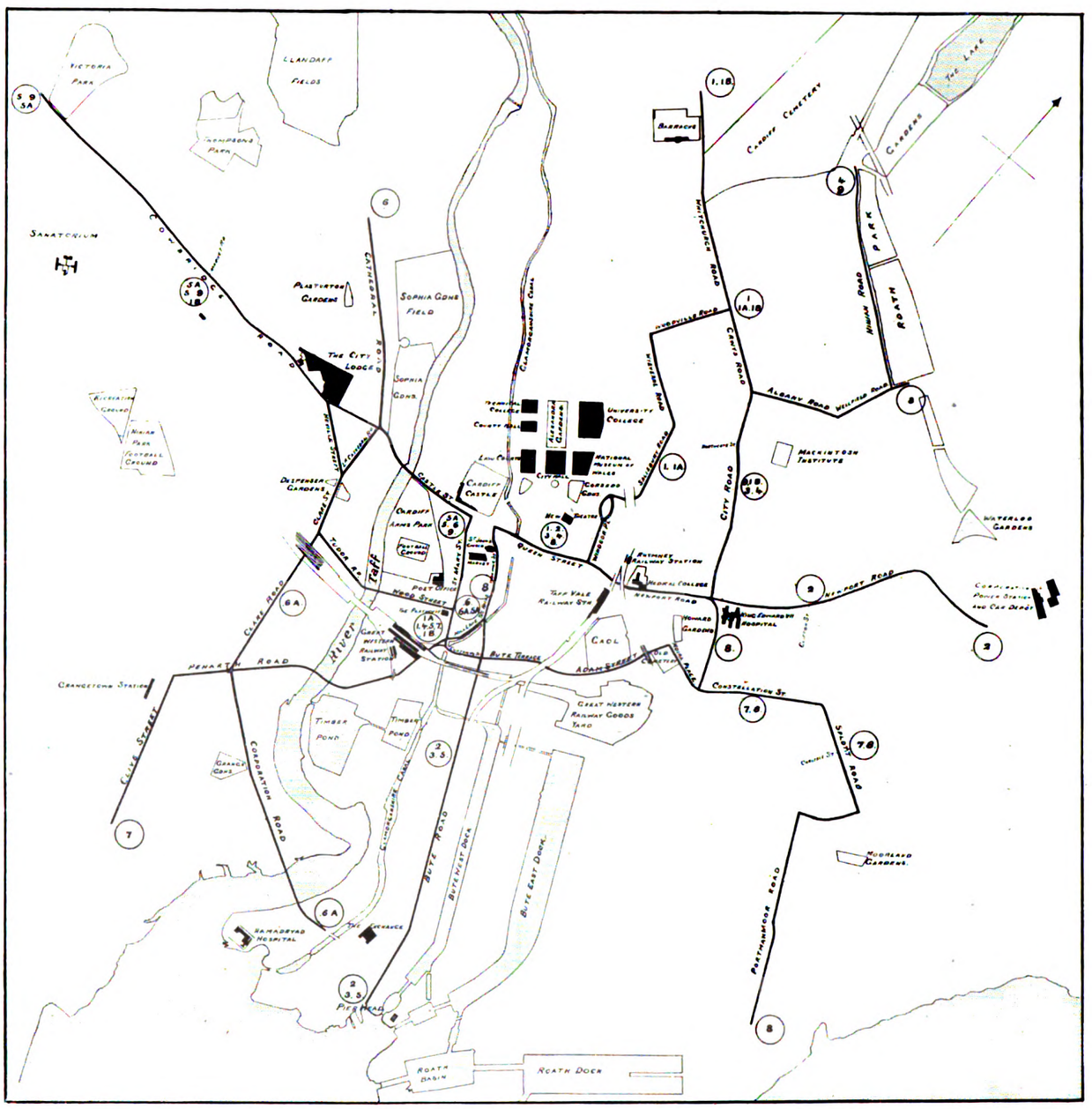
are shortly to be replaced by water tube boilers. A new building was put up in 1914 for housing two water tube boilers. The boilers work in conjunction with Green's fuel economisers on three chimneys, two short steel and one brick, assisted by a complete scheme of fan draught. A system of electrical distance thermometers, water recorders, and flue gas recorders enable a check to be kept on the efficient working of the plant. Three natural draught chimney cooling towers, capacity 625,000 gallons per hour, deal with the water required for condensing purposes. Three feed pumps were supplied by Messrs. G. and J. Weir, of Glasgow. These are of the vertical direct-acting type, each capable of delivering 6,000 gallons of water per hour against a pressure of 160 lb. per sq. inch. The tramways and electricity departments are fortunate in having the power-station on a site provided with a supply of water and a railway siding. Ultimately the whole of the reciprocating engines and Lancashire boilers will be replaced by large turbines and water tube boilers respectively. The electrical power generated is distributed from two converting sub-stations, one in the centre of the city at the Hayes, another in the docks district supplying direct current, and a number of transformer sub-stations supplying alternating current. At the present time the output for all purposes is over 16½ million units per annum delivered through 140 miles of cable.



Outline Map of Cardiff Corporation Tramways.

In some respects Cardiff is an ideal town for tramways. The city occupies a great plain between the sea and the coal field, and is practically flat. On the eight routes there are only four gradients, the most pronounced being 1 in 20. To some extent the tramways are handicapped by very low railway bridges, necessitating the reduction of head room inside the cars, and on two routes the use of single-deck cars. On the main route to the docks, where the majority of the cars are run, it has been possible to lower the roadway 15

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inches, thus allowing the double-deck cars to run under the bridge. The sharpest curve on the system is of 40 ft. radius. The original rails of the girder type were 45 ft. in length, having a weight of 100 lb. per yard. In reconstruction work the British standard No. 4 rail 60 ft. in length, has been used. The first rails were laid on a concrete bed 11 in. deep and 18 in. wide, the depth of concrete under the rest of the track being 8 in.

The original track was double bonded at each rail joint and cross-bonded every 3 yards, the work being done by the permanent way staff. The cables were laid in Doulton earthenware conduits, and the British and Helsby Cables Company, of Prescot, were contractors for the cables. The conduits were laid in concrete.

The whole of the overhead equipment was erected by the department, the standards, brackets, and bases being designed by Mr. Ellis, and made by Messrs. J. Russell and Sons. Centre poles are used chiefly, with side poles and bracket arms and span wire construction on some of the routes where the streets are narrow.

For some years two Milnes-Daimler petrol motor wagons were utilised for overhead repairs, but these have been replaced by two Edison battery wagons.

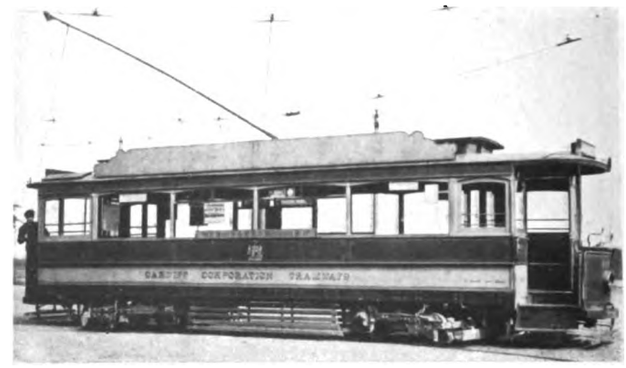
Double-Deck Single Truck Car.

These have proved in every way suited to the work. One petrol chassis has been fitted with rail welding plant, the possession of which has proved a great advantage to the department.

Four types of cars are used, namely, double-deck four-wheeled, with a fixed wheel base of 6 ft.; double-deck bogie car, with maximum traction trucks; single-deck bogie, with maximum traction trucks, the wheel base being 4 ft.; and single-deck bogie Brush truck smoking compartment cars. The four-wheel cars on the Brill No. 21 E type truck carry 52 passengers, 22 inside and 30 outside; while the double-deck bogie cars accommodate 68 passengers, 30 inside and 38 outside. The staircases on both single and double deck cars are of the double or broken type, with a platform half way up. The overall length of the four-wheel cars is 28 ft. 6 in. over the collision fenders, with platform 5 ft. 9 in. The internal length of the single-deck body is 16 ft. The single-deck bogie smoking cars measure 37 ft. 6 in. over the collision fenders.

On account of low bridges the overall height of the cars from the rails to the trolley plank is 9 ft., so as to leave 6 ft. clearance from the trolley plank or upper deck to the underside of the bridges. On this account it has only been possible to get an internal headroom of 6 ft. The double-deck bogie cars have an overall length of 34 ft. 6 in. over the collision fenders, the interior length being 24 ft. 4 in. and the platforms 3 ft. 9 in. each.

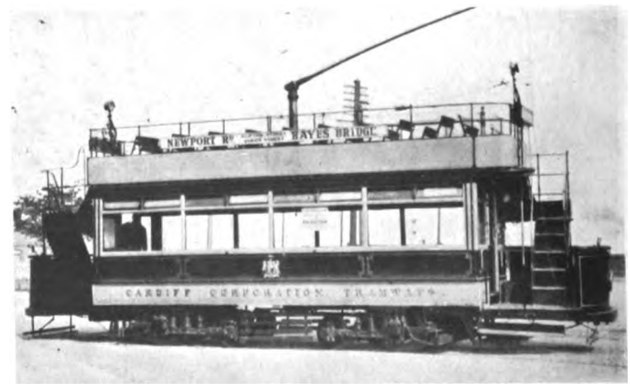
The internal finish of the four types of car is very handsome; the single-deck cars have clerestory roofs. The woodwork of both types is chiefly light and dark



Single-Deck Bogie Car.

oak, and the ceilings are of three-ply bird's-eye maple, divided into panels by oak mouldings. All the cars are fitted with illuminated destination indicators, made by the British Electric Car Company. The whole of the first lot of cars, viz., 20 double-deck bogie, 20 double-deck four-wheel, and 14 single-deck bogie cars, was supplied by Messrs. Dick, Kerr and Company, who afterwards received an extension order for 20 double-deck bogie cars and 20 double-deck four-wheel cars, making 94 cars in all. In 1905 fourteen single-deck cars were obtained, the seats being of the garden reversible pattern, accommodating 40 persons. The overall length of these cars is 37 ft. 6 in. over the fenders. The greater part of the platforms is devoted to smoking compartments, each seating five passengers. There are now 130 cars and an electric water tank. From the first every car has been provided with a complete set of tools, including a traversing and lifting jack.

The car sheds and depots are two in number. The chief shed adjoins the power-station, and the other is situated at Pendyris Street, adjoining the G.W. railway at the western end of the city. One hundred



Double-Deck Bogie Car.

cars are accommodated in the principal shed, and the other provides room for 32 cars. The main portion of the Roath shed consists of four bays, each 320 ft. long, with three tracks in each, the total width being 136 ft. At the side of the shed there are offices on the

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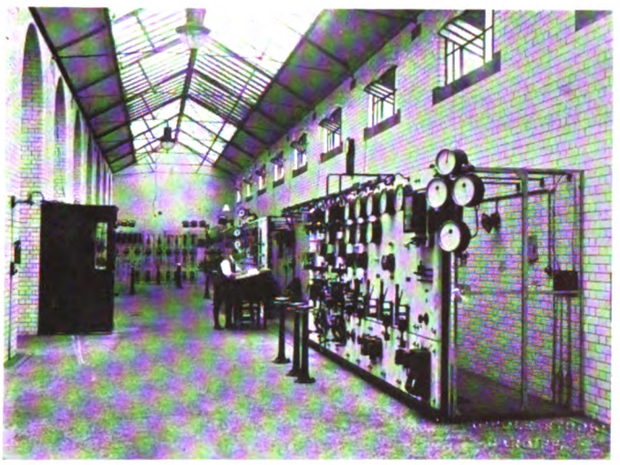
first floor for the foreman, clerks, and engineers. Below is an office for the timekeeper. The whole of the shed flooring and tracks are supported on columns, leaving a clear space under the cars 4 ft. deep. There



Switchboard Gallery at Roath,
With Single and Three-Phase Control Board and Traction Switchboard.

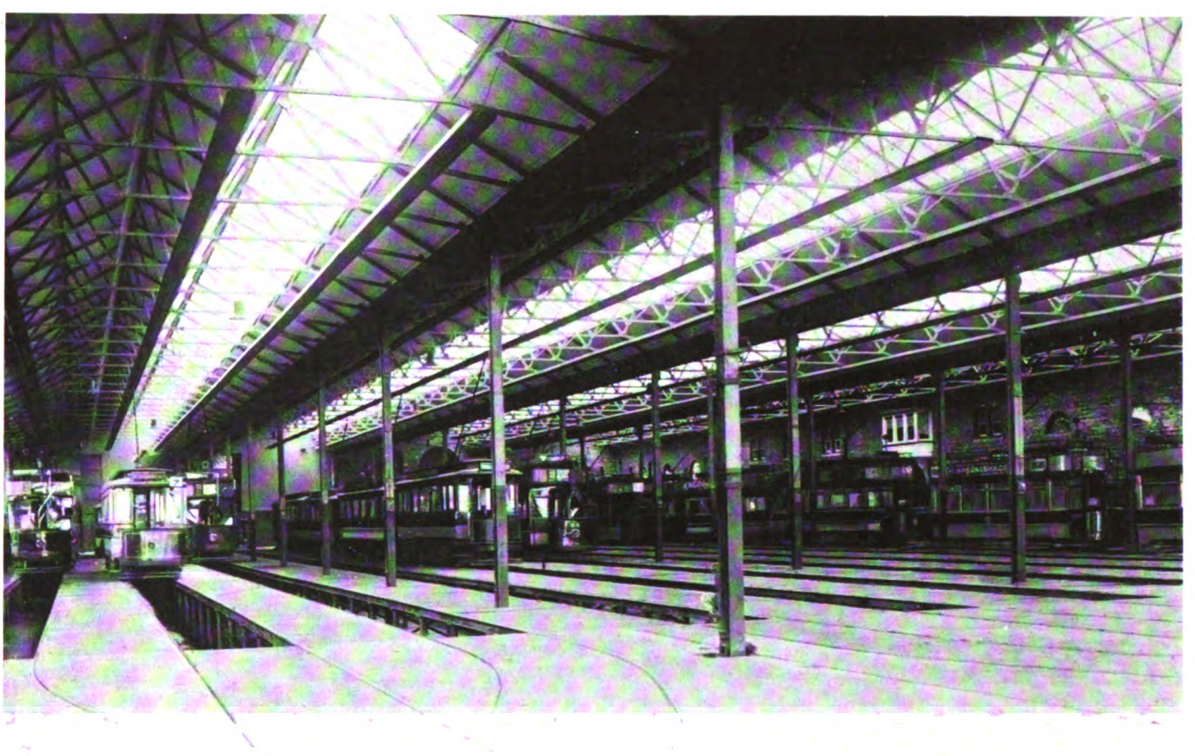
are four main entrances, and cars can also be taken inside the depot by means of a side track running along one side of the building direct to the electrically-driven traverser. This operates along the full width of the shed for transferring cars either from one track to another or into the repair shops beyond. The traverser pit is 25 ft. wide.

The repair shops consist of a machine shop 120 ft. by 66 ft., painting shop 90 ft. by 33 ft., smithy 29 ft. by 25 ft., and carpenter's shop 29 ft. by 25 ft., together with mess-room for the men, oil stores, sand stores, etc. The foreman in charge of this part of the shed has an office between the paint shop and the machine shop, and has a complete view of the whole interior. Messrs. D. W. Davies erected the Roath and Pendyris depots.

TASK OF RECONSTRUCTION: LEGACY OF THE WAR.

The high view which successive tramways committees have taken of their responsibilities at Cardiff, and the soundness of the advice of the general manager, find reflection in the fact that the undertaking has a renewals fund of £182,690. This was accumulated between May, 1902, and March, 1920, the latter date being only three months after the retirement of Mr. Ellis to undertake private work. Debt repaid has totalled £432,010 and the net debt remaining is £371,412.

At the outbreak of war Cardiff Tramways had become a flourishing institution, thanks to wise administration and alert management. Until that time renewals and renovation of the rolling stock, etc., were made in regular order, the tramways being maintained in a high state of efficiency. The city engineer was well forward with the repair and renewal of sections of the permanent way. Some eight or nine miles of track in the busier streets had been renewed by 1915, and short lengths of single and interlaced line had been converted into double line. This was the case in Ninian Road. Roath Park section, over which a very heavy summer pleasure service is run, was converted from single line with passing places to double line throughout. Similar progress was made in Queen Street, Newport Road, and City Road.



Interior of Roath (Main) Car Shed—Cardiff Corporation Tramways.

Then came the difficulties of the war, the shortness of material and labour preventing any further work of this character being continued, with the consequence that both the rolling stock and the track deteriorated to such an extent that it is below the ideal which the Cardiff Committee have always had in mind. They may, however, be congratulated on the fact that had

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it not been for the high sense of duty animating them before the war the physical condition of their undertaking would now have been most unsatisfactory.

Every energy has been devoted since the end of the war to securing materials and labour, with the result that 100 of the 130 cars are now in service, while track renovation proceeds as fast as possible. Traffic has continued to increase year by year, the total number of passengers for the year ended March 31, 1920, being 41,946,385, an increase on the previous year of 5,600,258. Car-miles run numbered 2,553,161, as compared with 1,899,601 for the previous year. Besides its industrial traffic, Cardiff makes a very large pleasure demand upon its tramways. This is chiefly experienced on the Roath Park and Lake section, those places being centres for concerts, promenades, pastimes, boating, and bathing. Indeed, it may be said that practically every service can be utilised for viewing places of interest. The lines linking the railway station with the pier head have to bear heavy traffic at uncertain periods to accommodate the pleasure steamer services, causing the traffic staff to be ever on the alert in the summer months. Pleasure demands have shown continual increases since the termination of the war, and they have to be met with resources that cannot yet be sufficiently increased, owing to the after-effects of the war upon production in this country.

Inconspicuous Side Pole Construction of Tramways in St. Mary Street, Cardiff.

Tramway Junction at Newport Road, Cardiff.

FUTURE DEVELOPMENTS.

On every hand the Corporation intend as soon as possible to provide for future passenger transport wants of the public, both inside and outside the city. Under powers already obtained motor omnibuses will soon be working between Cardiff and the popular residential resorts of Penarth, Llanishen, Whitchurch, Newport, and Llandaff. These services will open up a very wide area, in which there is a large population. The entry to Newport is a reminder of Mr. Arthur Ellis's foresight as to the need for light railways in the district. At last a practical means has been taken for testing and developing the traffic. Another development is to be expected from the Corporation having purchased by arrangement with the Councils of those places the toll-gate standing between Cardiff, Penarth, and Barry.

In another manner the tramways department is proving of value to residents and visitors, namely, by the parcels delivery service, which extends to places a mile or so off the tramways, while the offices may also

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be utilised for leaving articles as in a railway cloak-room. The institution of passenger queues at points of pressure has added to the comfort of the public and accelerated the services. Plans are under consideration for erecting overhead shelters at these points. In

Exterior of Cardiff Corporation Electric Station.

order to cope with the increased work of body building, repairing and painting, steps are to be taken for securing a suitable site for a new building for that purpose.

Any account of the Cardiff Tramway system would be incomplete without an allusion to the devoted services rendered to it by Sir John Courtis, who has been chairman of the Tramways Committee for the past ten years. The initiation and development of the system have been largely due to the ability and enterprise with which he has guided the policy of the Corporation in their effort to provide the excellent facilities that now play so great a part in the daily life of the citizens.

AMERICAN ELECTRIC RAILWAY FINANCE.

A voluminous report was issued at the end of August by the Federal Electric Railways Commission appointed by the President of the United States in the end of May, 1919, to inquire into the position of electric railways (for the most part street and road tramways) in the United States, and particularly to investigate the disastrous financial position of many of them, and to suggest remedies. The Commission held sittings in the summer and autumn of last year and examined numerous witnesses for the railway companies, local authorities, and other interests. So diligent were they that the sittings frequently lasted from ten in the morning till ten or eleven at night. The financial position of many of these companies is much worse than that of tramway undertakings in this country, owing among other things to increased cost of everything during and since the war, to the difficulty of getting power to abandon the hitherto universal five-cent fare within city limits and to impose adequate fares, and in some cases at least to the over-capitalisation of the companies brought about by financial manipulation in pre-war times. As is well known, the financial condition of many of the companies is, or has been, absolutely desperate, and many are in the hands of receivers. The essence of the report of the Commission is contained in 22 conclusions and recommendations. Many of these set out facts and circumstances which are well known to all concerned in the industry, but the advantage of stating them from such a source is to bring then home to the mass of the American people who have so often shown themselves hostile to the street railway companies. Daylight has been cast on much that has been obscure, and a good case for the industry has been made out. The American public seem to have been too much in the dark on the matter; henceforward they will know how the land lies and how their interests can be advanced in regard to local transit, while at the same time justice is done to the companies.

The conclusions referred to open by asserting that the electric railway should have the sympathetic understanding and co-operation of the public. The industry is without financial credit and is not properly performing its public duty. Economies in operation, improvement in tracks, equipment and service, and a reasonable return on the fair value of the property are essential. The first necessity is to restore credit in order to obtain the requisite new capital. This involves the removal of public antagonism and the providing of public co-operation. A suggestion which will make the mouths of tramway authorities in this country water is that extensions resulting in special benefits to property should be paid for by assessments on such property, and the assessments should not be added to the physical value of the railway. Automobile services should be subject to regulations equivalent to those on the street railways. Labour troubles should be settled voluntarily or by arbitration. Public control of electric railways must be flexible enough to enable them to secure sufficient revenue to pay the entire costs, including capital and labour. There must be fair valuation of the properties and the companies should then reduce any excessive capitalisation to the basis of the valuation. This, it may be remarked, is a crucial point, though it only occupies a short paragraph in the recommendations. The Commissioners also think that there is no insuperable objection to a large wide-awake city having exclusive jurisdiction over the rates and services of public utilities, but local regulation should generally be subject to the authority of the State. In the light of American conditions, the following is significant: "While eventually it might become expedient for the public to own and operate electric railways, there is nothing in the experience thus far obtained in America which will justify the assertion that it will result in better or cheaper service than privately operated utilities could afford if properly regulated." There is a great deal behind this sentence: "Public ownership and operation of local transportation systems is now, because of constitutional and statutory prohibitions, financial and legal obstacles, the present degree of responsibility of our local governments, and the state of public opinion, practicable in so few instances, that private ownership and operation must as a general rule be continued for an extended period." Does this sentence not recall to the older if not the younger of British tramway officers the famous report of Mr. Dalrymple, the Glasgow manager, to the fathers and brethren of Chicago Municipality on the question of municipal ownership and management under American conditions? There are a few publicly owned and worked tramways in America nowadays, but the method has still to make good. From the indications of the report of the Commission given above, it will be seen that the American public have now a chance of getting on the right lines in the matter. Legislative and municipal action are, however, required.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, OCTOBER 14, 1920.

Standardised Electrification.

The recommendations contained in the report of the Electrification of Railways Advisory Committee are of the first importance to the railway and electrical industries of the country. The report, the text of which appears in this issue, is an interim one, and deals only with general points, further matters being left over for a subsequent report. The members of the committee include some of the leading authorities in railway and electrical engineering, and their decisions, which, happily, are unanimous, will command wide acceptance. In order to ensure the future electrification of railways in this country being carried out to the best advantage, the committee consider that general regulations should be made, directed specially to ensuring standardisation of the most satisfactory methods and appliances. The obvious objection that rigid standardisation might mean stagnation is met by the further proposal that the regulations should put no avoidable difficulties in the way of the adoption in future of any improvements in methods or appliances which may become available with increasing knowledge and experience. This caveat in the case of such a progressive art as electrical engineering is absolutely indispensable, but it remains to be seen how far standardisation can be carried without preventing new developments and improvements. The main object of standardisation, of course, is to secure interchangeability of electric locomotives and rolling stock, so that through electric trains may be run over the lines of two or more companies, just as is now done in the case of steam trains. The next important point made by the committee is that all future electrification should be carried out on the direct-current system, with a standard pressure at the sub-station busbars of 1,500 volts. In these pages we have from time to time expressed the view that the high-pressure direct-current system is preferable even for long-distance working to the single-phase alternating-current method, and it is gratifying to find that opinion confirmed by a committee of such calibre. Should the proposals be adopted by the Ministry of Transport—as there is every reason to suppose—there will be an end in this country to "the battle of the systems," unless in the future some new and important discovery leads to its renewal.

* * * *

The standard pressure proposed is subject to the continuance of any existing 600 volt and 1,200 volt installations and to their extension with the approval of the Minister of Transport. It is likewise subject to the adoption of half the standard voltage or of higher pressures, multiples of the standard, where such can be shown to be of advantage. Thus there is ample provision against needless scrapping of equipment on existing electric railways. While the highest direct-current working pressure at present used in this country is 1,200 volts—on the Manchester-Bury section of the Lancashire and Yorkshire Railway—the committee do not give any reasons for fixing their standard at 1,500. The only disadvantage, however, of the figure is that it is not a multiple of the present customary 600 volts. On the other hand, it is desirable to use as high a pressure as possible so as to minimise the number of sub-stations, to reduce the section areas of direct-current feeders, and to obtain lighter motors. Fifteen hundred volts is probably about as high a pressure as can be conveniently used if proper insulation of the third-rail conductor is to be maintained; and the committee recommend that both the third-rail and the overhead conductor

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should be permitted. Moreover, 1,500 volts is about as high as can be used on a traction motor, subject as it is to vibration and jolting, without serious flashing-over between the brushes. The idea evidently is to provide that full-speed running should be done with all the motors in parallel. In the case of some railways in America using higher direct-current voltages, two or more of the motors on the locomotive are always in series, so that the pressure across each motor is kept low. If an existing 600-volt railway is to run its trains also over a 1,500 volt railway, then the pressure used on the former can readily be raised to 750 volts by altering the tappings of the sub-station transformers. The same motors will serve for the 750-volt pressure, and when the train gets on to the 1,500 volt line the motors will have to be grouped in pairs, the two of each pair being always in series. This will require modification of the control arrangement.

* * * *

In their future report the committee will make recommendations as to the position and design of conductors and structures and as to ensuring the locomotives and motor coaches shall be able to run at two different voltages, e.g., 750 and 1,500, and with either rail or overhead collection. The committee do not go into that matter now, but we have indicated a method above. As to generation of current, the committee recommend the continuance of the three-phase high-tension system, and that in the case of existing stations supplying at any frequency between 25 and 50 cycles, it is unnecessary to make any change in frequency. Any new power-station should adopt the frequency approved by the Electricity Commissioners or the one in general use in the district. In conclusion, the committee give separate consideration to the case of the London, Brighton and South Coast Railway, and recommend that the single-phase system now in use there need not be changed, though they hint at future possibilities in connection with the railway forming one of the proposed southern group of railways. To change the Brighton Railway to the direct-current system would involve large expense. In general it may be said that this interim report, issued at as early a date as possible, lets the railway companies know where they are likely to be in connection with electrification.

London and Paris.

While Paris has lately brought all its surface passenger transit undertakings under the ownership of the Conseil Général and arranged for their operation by a company, of which M. Mariage will be in chief control, London has failed to come to an arrangement for the abatement of the competition that has rendered tramways and omnibuses unremunerative. Still, the recent conference between representatives of the County Council and of the traffic group, under the presidency of an official of the Ministry of Transport, proved that the two bodies are not lacking in the will to arrange amicable working, although the meeting could not agree on financial proposals. An important advantage possessed by Paris rested in the fact that the city had leased the privilege of working to various companies. As in London, operation had become unremunerative, and the six companies have been bought out for a sum of just over 39 million pounds, comprising 30 annuities, the largest going to the General Omnibus Company. A 30 years' lease has been given to the new company, which will be paid interest at the rate of 6 per cent. per annum, or 4·9 per cent. after payment of taxes. A further incentive is given in the form of premiums on the net receipts and on economies which may be brought about. These premiums are in part to go to the heads of departments, and partly for the accumulation of a reserve fund of £120,000. A novel provision is the payment to the workers of all grades of 4 per cent. of the passenger and advertising revenue. Thus we see carried out, for the furtherance of economical working, the idea of giving a financial interest to employees. This principle was supported by the general manager of the London County Council Tramways at the conference of the Municipal Tramways Association. While the London difficulties in the way of harmonious working are great, the problem should be capable of solution. Possibly the first step in new negotiations may result from the adoption, in self defence, by the Omnibus Company of the 2d. all the way fare on competing routes. That company has stated its intention to submit for examination the records of the result of this traffic if the Council will adopt a similar course. Long before the expiration of the period named

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by the company, the participants in this blind rivalry will be able to determine whether the proceeds justify its continuance. In that event one side will be reaping a loss, and will be forced to revert to the ordinary fares. It may be anticipated, however, that if one party is forced by circumstances to abandon the low mid-day fares, their competitor will not continue in a course that may perhaps meet expenses but will not provide any surplus.

Lord Ashfield's Suggestions.

In considering possible means of bringing about harmonious working between the London undertakings some enlightenment may be gained by examining proposals which are on record. Space does not permit of a glance at the report of the abortive meeting which took place towards the end of the war. Its purpose was to eliminate unnecessary competition at a time when both tramways and omnibuses were hard pressed to meet public requirements. Some useful suggestions may, however, be found in a paper contributed by Lord Ashfield to a London review in May last on "London Traffic Problems." The chairman and managing director of the allied companies holds that the best method of securing a satisfactory solution is by a traffic pool, out of which the losses of one agency may be met by the gains of another. He offers alternative solutions of the problem of controlling the traffic. One is the board or commission of three members, whose task would be to adjudicate upon the disputes before them with a view to smoothing out all the obstacles to a co-ordination and development of all transport agencies. The other is the handing over of all the undertakings to private enterprise and the arming of the local authorities, severally and jointly, with such powers as may be requisite to secure the conduct of traffic in a fair and impartial manner towards the public. The advantage of private enterprise, Lord Ashfield adds, is that the business must be managed and conducted on a commercial basis, even on a competitive basis; but he insists that competitive management does not imply competitive finance. Finally, he says—"The conclusions appear simple, but it is appearance only; underlying each of them, as this article has attempted to show, are controversies which can only be settled by men of goodwill." The main controversy, of course, is that London traffic is mixed with party politics. As long as that absurd situation continues, the outlook is hopeless. The task now facing "men of goodwill" is to convince the ratepayers that in co-ordination rests the only hope of adequate, solvent, or remunerative service. At the head there must be an impartial Traffic Board. For the mode of operating the facilities the example of Paris affords scope for investigation.

STATE AND RAILWAY AGREEMENTS.

COMMITTEE OF INQUIRY.

The Ministry of Transport has appointed a departmental Committee on Railway Agreements to consider and report as to:—

(1) The nature and terms of the agreements made between the Government and the railway companies relating to the possession by the Government of the undertakings of the companies.

(2) The possible extent of the outstanding liabilities of the State thereunder, according to the interpretations which may be placed upon such agreements.

(3) Whether, with due regard to cost, any further steps should be taken to secure that the interests of the State in reference to such agreements are adequately safeguarded.

And generally to make such recommendations as appear desirable in the circumstances.

The Committee is composed as follows:—Lord Colwyn (chairman), Major H. Barnes, M.P., Sir Godfrey Collins, M.P., Mr. William Graham, M.P., Sir Hardman Lever, K.C.B., Sir Halford Mackinder, M.P., Sir Thomas Robinson, M.P., and Mr. W. Peter Rylands.

Mr. E. Twentyman, Ministry of Transport, will act as secretary, and all communications should be addressed to him at the Ministry of Transport, 6, Whitehall Gardens.

NATIONAL JOINT COUNCIL.

FINAL MEETING OF THE FIRST YEAR.

At a meeting of the National Joint Council of the Tramway Industry held on September 29 there was a full attendance of the representatives both of the employers' and the employees' sides. Sir John Courtis presided in the morning, and in the afternoon the vice-chairman, Mr. H. Hirst. We understand that long discussion took place on the question of inspectors joining unions affiliated to the National Transport Workers' Federation. The employees were insistent that if the inspectors did join any union it must be one affiliated to that Federation. On the other hand, the employers insisted that the inspectors should be free to join whatever union they thought fit. In their opinion the National Council ought not to be used as an instrument of coercion, and all provisions in regard to unions must be permissive. No definite decision was arrived at.

The Southampton strike case was considered. Both sides were heard, and eventually the Council deputed Councillor Higham for the employers and Mr. Hirst for the employees to visit Southampton to act as mediators with plenary powers to determine whatever issue might be raised.

The question of the standardisation of the basic rates of wages throughout the country was brought forward. Requests were received from two District Councils that steps should be taken for standardising the basic rates, but after discussion it was agreed that as this was the last meeting of the existing Council, the subject was too large to be dealt with by an expiring body. In order to make a beginning, the three joint secretaries were instructed to carry out preliminary investigations.

The first meeting of the new Council will be held on October 14. Meantime all the nine District Councils have again elected representatives.

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THE MUNICIPAL TRAMWAYS ASSOCIATION

(INCORPORATED)

19th Annual Conference held at Cardiff September 15, 16 and 17, 1920

SPECIAL REPORT.

The nineteenth annual conference of the Municipal Tramways Association, which was held at Cardiff from September 15 to 17, perpetuated and strengthened the traditional success of these annual meetings. Nothing was left undone to render the conference both interesting and enjoyable to the large number of members and delegates who attended, while the papers read and the discussions that took place, as will be gathered from the full report of the conference given in the following pages, undoubtedly clarified some of the problems with which tramway administrators are now faced. These problems must present difficulties for a long time to come, but the proceedings showed that they are on the whole progressing toward a satisfactory solution. The members may well have derived encouragement from the way in which the Cardiff Corporation has dealt with its own problems. There was evidence on every side that a healthy optimism has long been a characteristic of the Corporation, and the results in many respects are admirable. Not the least striking feature of the progress that has been made is the magnificent range of public buildings situated in a park almost in the centre of the city, the outcome of plans initiated with great foresight by councillors who guided the fortune of the city many years ago. It was in the City Hall, one of the most beautiful of modern municipal buildings, that the meetings of the conference were held. In the Council-room on the Wednesday morning the Lord Mayor (Councillor G. F. Forsdike) cordially welcomed the Association, dwelt upon the importance of its work, and expressed a hopeful view of the industrial position. In the Industrial Councils, if conscientiously worked on both sides, he felt that there was a means of arriving at an honest and fair decision in the case of disputes.

Alderman Sir John Courtis, president of the Association, briefly thanked the Lord Mayor for his welcome, and then delivered his presidential address. He expressed a hope that could hardly fail to be pleasing to his hearers that their visit to the commercial capital of Wales would not only promote the general interests of the tramway industry, but would afford them a brief respite from the unexampled stress and anxiety that had followed the war. There were doubtless mixed feelings as to the benefits arising from the statute when Sir John reminded them that this was the fiftieth anniversary of the passing of the Tramways Act. The president afterwards launched into tramway statistics based on the recent summary issued by the Ministry of Transport. These gave eloquent testimony of the growth of the tramway industry in this country. Dealing with the necessity for providing further facilities, he said that the form of these, whether tramways, railless systems, or omnibuses, could be decided only by experience. In the meantime tramways held the field where large numbers of passengers were concerned. The president also dealt with the subject of increasing fares, and maintained the paramount necessity of passengers paying for the service and of placing no charge on the ratepayers at large for the cost of tramway operation. Otherwise financial chaos would result. The Tramways (Temporary Increase of Charges) Act must be used to make tramways self-supporting. This led him to a review of advances in wages, and, like the Lord Mayor, he attached the utmost importance to the National Industrial Councils in the attempts to discover a solution to the most pressing problem of the time. Among other things to which Sir John referred was the desirability of adopting the proposals of the committee on the standardisation of overhead line material.

THE CONFERENCE.

The main subject of the conference, viz., tramway fares, was then introduced by the reading of two papers, one by Councillor C. Higham (Blackburn) and the other by Mr. P. Priestly (Liverpool). The former pointed to the troubles involved in increasing fares so as to meet the higher costs. Any proposal of the sort has to run the gauntlet of the tramways committee, the Town Council, and public criticism. He contended that in most towns the time had arrived for the abolition of the penny fare, arguing that short distance passengers should not escape the general increase in fares. In supporting the abolition of workmen's fares he pointed out that workmen were not given specially cheap rates for gas or electricity. Mr. Priestly in his paper also maintained that tramway undertakings should be run on a commercial basis and should accumulate funds for renewals, improvements, and extensions. He favoured the plan of a high minimum and a low maximum fare, but each passenger must pay the full cost of his ride. A central point should be taken as a tramway terminus, and from that point the system should be divided into mile zones. He opposed the granting of workmen's fares and contract tickets.

In opening the discussion, Alderman F. Smith (Liverpool) contended that contributions from tramway revenue to the rates should be continued. Mr. W. Murray (Walthamstow) pointed out the danger to small undertakings of raising fares, as people might choose to walk. For the same reason the minimum fare should not be raised above a penny. Mr. E. S. Rayner (Hull) spoke of the desirability of leading the public to recognise the necessity of paying 2d. for what used to be a 1d. journey, and urged the necessity for the introduction of a three-halfpenny coin. Mr. J. B. Hamilton (Leeds) took the same view as to fares. In each town a proper calculation should be made of what each fare ought to be, in order to provide the necessary revenue. Councillor W. J. Squires (London) and other speakers agreed as to the necessity of increasing fares.

At this point adjournment was made for luncheon, at which the members were entertained by the chairman (Sir John Courtis) and members of the Cardiff Corporation Tramways Committee. The Lord Mayor, in proposing "The Municipal Tramways Association," referred to the thankless task of those engaged in public work, and maintained that British local authorities were carrying on their voluntary tasks extremely well under exceedingly trying conditions. All the pressure that could be brought to bear on Government departments was necessary in order to see that municipally-owned tramway undertakings had reasonably fair treatment. He expressed his pleasure that Mr. John Young, the first president of the Association, was with them that day, and alluded to his notable record as manager many years ago of the Glasgow Corporation Tramways. Sir John Courtis responded. The Sheriff of Belfast (Councillor W. C. Turner) proposed "The Chairman and Members of the Cardiff Tramways Committee," and Alderman Morgan Thomas responded.

When the conference was resumed, Mr. Henry Mozley (Burnley) contended that to abolish workmen's fares was against public policy, but little support was given to this view. Mr. J. M. McElroy (Manchester) agreed that before fixing fares the actual costs should be ascertained. The public would be willing to pay when they were informed as to the cost. Other speakers continued the discussion, and Messrs. Higham and Priestly briefly replied.

Mr. A. L. C. Fell, general manager of the London County Council Tramways, then read an interesting and useful paper on "Operating Costs: Power Expenses," in which he argued that it should be possible to effect large economies. He dealt with the bad quality and high cost of the coal now obtainable for generating stations. The whole arrangements for grading coal should be co-ordinated by the suppliers and transport agencies, so that the quality supplied should improve as the distance from the source became greater. There was no reason why the possibilities of oil fuel for power-stations should not be taken into consideration. He described successful experiments for the burning of coke. He also suggested that great benefit would arise from having the assistance of a fully qualified chemist at the power-station for analysing fuel, ash, gases, etc. As to other economies, he dealt with bonus schemes for reduction in power consumption and the use of trailer cars.

Mr C. J. Spencer (London) strongly supported the bonus scheme. The tramcar was the cheapest vehicle to run, but it could be made a good deal cheaper if as much scientific attention had been devoted to its improvement as has been directed to the development of the motor omnibus. He believed they were on the verge of great improvements. Mr. R. G. Cunliffe (Manchester) spoke of the possibility of obtaining higher efficiency and economy in tramcar equip-

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THE MUNICIPAL TRAMWAY ASSOCIATION AT CARDIFF.

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ment. Mr. A. R. Fearnley (Sheffield) maintained that tramway methods and systems were generally up to date. Alderman Palin (Bradford) and Councillor Campion also took part in the discussion.

In the evening a reception was held by the Lord Mayor and Lady Mayoress, supported by Sir John and Lady Courtis. During the evening a concert was given by a choir of some forty women singers, which was greatly enjoyed. Light refreshments were provided, and the visitors were able to view a number of interesting paintings in the City Hall, which affords an admirable *milieu* for social gatherings.

THE SECOND DAY.

At the second day's session of the conference a paper on repairs and depreciation in relation to capital and revenue, by Mr. James Dalrymple, Glasgow, was in his unavoidable absence read by the secretary (Mr. J. Beckett). Mr. Dalrymple urged the necessity of keeping undertakings in a complete state of repair, and of setting aside the necessary sums for depreciation. He found that in the case of various tramways this was not being done, so that the tramway capital was being tampered with. The revenue from fares should be sufficient to meet all charges.

Mr. R. L. Horsfield, general manager of Cardiff Corporation Tramways, also submitted a paper on "Repairs and Depreciation in Relation to Capital and Revenue." Provision for debt redemption only within the assumed useful life of the asset was, he urged, not prudently sufficient. A sinking fund also was not a depreciation fund. It was therefore of the utmost importance that proper provision should be made to meet future necessities as well as contingencies. The depreciation fund was not only the tangible expression of municipal thrift; it was to-day's recognition of to-morrow's demands, and it would be neglected to the certain detriment of the tramway undertaking. This fund should stand apart from capital redemption, and should be jealously guarded and kept inviolate. On the other hand it should stand definitely and continually related to revenue account. For wasting assets that could not be restored annually, some provision should be made in the net revenue account, and no balance surplus should be treated as profit until that had been done. The tendency of some authorities to borrow for renewals should be checked at its inception; it was likely to lead to an authority finding itself in financial difficulties.

In the course of discussion Alderman Fenton (Sheffield) spoke of the injustice of tramway undertakings having to maintain the paving between the rails. If that charge was put on the right shoulders it would largely solve the difficulty as to fares. Several other speakers took the same view. Mr. H. P. Stokes (Plymouth) was of the opinion that in cases where capital had been nearly paid off renewals should be carried out by means of new capital. Mr. W. Murray questioned whether it was fair to call on the present generation to provide debt-free tramways for their successors. Mr. J. M. McElroy pointed to the magnitude of the problem, having regard to the present high cost of renewals, of setting aside out of present fares such a sum as would meet the whole of the renewals. The ideals put forward by the writers of the two papers would have to go. Tramway authorities would have to consider the question of re-borrowing. This view was supported by Mr. C. Furness (Blackpool), while Alderman West (Walthamstow) thought it would be better to obtain powers to defer the repayment of capital. Mr. J. B. Hamilton said the latter scheme would amount to an admission that money had been borrowed on false pretences. He agreed that the wear of the street setts caused by other traffic should be charged to the highways authority. As to renewals, there should be some means for obtaining loans to meet them.

"The Future of Capital Expenditure" was the title of a paper presented by Mr. R. Stuart Pilcher (Edinburgh). He said that the question of new capital expenditure would solve itself if the revenue could be made to increase at the same rate as the working expenses. He advocated the gradual raising of fares. He also made a comparison of the capital cost of an electric tramway system for Edinburgh as compared with that of an installation of motor omnibuses, and in general said that extensions and new routes would probably take the form of motor omnibuses, or other vehicles not dependent on a costly permanent way.

Some of the members who discussed the paper pointed to the high working expenses of omnibuses, and others supported the claims of the trackless trolley car. Mr. J. B. Hamilton referred to the economy in construction and the high speed possible when open tracks were adopted for suburban extensions.

The discussion was concluded shortly after one o'clock, and the annual luncheon of the Association was then held at the Royal Hotel. Sir John W. Courtis presided, and Mr. E. W. Holford (vice-president) proposed "The Cardiff Corporation Tramways," to which Alderman R. J. Smith responded. The toast of "Our Visitors" was proposed by Alderman Mayne (Sheriff of Newcastle-upon-Tyne), who spoke of the advantages that had been derived from the co-operation of the two Tramway Associations. Mr. H. M. Todd, president of the Public Ownership Association of America, replied, and warmly praised the high standard of municipal government in this country.

In the afternoon a photograph of the conference was taken, the members standing on the steps of the Law Courts, one of the fine group of buildings surrounding the Town Hall. Subsequently the annual meeting was held, when the long report of the Executive Council, fully covering the work of the past year, was adopted. Elections of officers and members of the committee were then held, and resulted in the appointment of the following—

PRESIDENT.

Mr. G. W. Holford, general manager of Salford Corporation Tramways.

VICE-PRESIDENT.

Alderman R. Mayne, Sheriff of Newcastle and chairman of the Tramways Committee.

HONORARY TREASURER AND SOLICITORS.

Mr. A. R. Fearnley, general manager of the Sheffield Corporation Tramways, was re-elected honorary treasurer, and Mr. P. M. Heath, deputy Town Clerk of Manchester, was appointed one of the honorary solicitors, Mr. S. F. James, Town Clerk of Ilkeston, being re-elected in that capacity.

COMMITTEE MEMBERS.

A ballot was taken for the election of three manager members and two councillor members of the executive committee, and resulted as follows—

Mr. J. M. McElroy, general manager, Manchester Corporation Tramways.
Mr. A. Baker, general manager, Birmingham Corporation Tramways.
Mr. H. Mozley, general manager, Burnley Corporation Tramways.
Councillor C. Higham, chairman, Blackburn Corporation Tramways Committee.
Councillor E. H. Sellers, chairman, Huddersfield Corporation Tramways Committee.

The General Secretary announced that offices had been secured at 5 and 6, Clements Inn, close to the Law Courts, which would become the headquarters of the Association in a few weeks.

A cordial vote of thanks was accorded to the Lord Mayor and Corporation of Cardiff for the charming hospitality that had been extended to the Association. The out-going president, Sir John Courtis, was also warmly thanked for his services during the year, as was the executive council.

On Friday the members made an excursion to Cheddar. Crossing from Cardiff to Weston-super-Mare, they were thence conveyed by comfortable motor coaches of the Bristol Tramways and Carriage Company to Cheddar, where the remarkable caves were visited and luncheon was taken. Late in the afternoon the return was made to Weston-super-Mare, and punctually accomplished by all of the motor coaches, whose smooth running was generally remarked. This brought the programme of the conference to a close, and the members separated with the pleasantest impressions, and will long recall the delightful way in which they were made welcome to Cardiff. In spite of occasional lapses of the weather the conference was throughout interesting and enjoyable, and it takes its place in the history of the Association among the most successful of its annual gatherings. The Lord Mayor (Councillor G. F. Forsdike) and Sir John Courtis were indefatigable in their efforts to ensure the comfort and enjoyment of the visitors, and their geniality and tact were unfailing. Sir John presided over the proceedings with his usual ability, and the work of the conference could not have been carried on more efficiently or agreeably than it was under his direction. His year of office has been probably more strenuous than that of any of his predecessors, and he has well earned the cordial vote of thanks that was enthusiastically accorded to him.

Mr. R. L. Horsfield, general manager of the Cardiff Corporation Tramways, and Mr. J. Beckett, the general secretary of the Association, won the grateful appreciation of all present by the untiring care with which all arrangements down to the smallest detail were planned and carried out.

LIST OF MEMBERS AND DELEGATES.

Honorary Members ...	John Young. C. J. Spencer.
Aberdare	A. J. Abraham, general manager. H. King, traffic manager.
Aberdeen	Councillor D. W. Beaton, convener. William Forbes, general manager.
Accrington	Councillor F. Lord, vice-chairman. Alderman J. C. Lupton. H. Pilling, general manager.
Ayr	Bailie J. R. Learmont, convener. John Young, tramways engineer.

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LIST OF MEMBERS AND DELEGATES *(Continued).*

Barrow	J. R. Groves, general manager
Belfast	Councillor W. C. Turner (sheriff), chairman. J. S D. Moffet, general manager.
Birkenhead	C. Clarke, general manager.
Birmingham	Councillor W. E. Lee, chairman. Councillor H. Bishop. J. McDonnell, deputy general manager.
Blackburn	Councillor Chas. Higham, chairman J. H. Cowell, general manager.
Blackpool	Councillor H. Brooks, chairman. Councillor T. G. Lumb, vice-chairman. C. Furness, general manager.
Bolton	Councillor J. R. Horrocks, chairman. Councillor F. Cheadle. J. Barnard, general manager.
Bradford	Alderman E. Priestley, chairman. Councillor I. F. Akeroyd, vice-chairman Alderman J. H. Palin. R. H. Wilkinson, general manager. John W. Dawson, assistant engineer.
Brighton	Councillor T. J. Braybon, vice-chairman William Marsh, engineer and manager.
Burnley	Councillor E. Heap, chairman. Councillor D. D. Irving, vice-chairman Henry Mozley, general manager.
Burton	A. B. Slater, general manager.
Bury	Alderman T. S. Collinge, chairman. Councillor H. Hargreaves, vice-chairman. F. Buckley, general manager.
Cardiff	Alderman Sir John Courtis, Kt. (president of the Association), chairman. Councillor W. H. Renwick. Councillor J. Taylor. R. L. Horsfield, general manager.
Chester	Alderman J. Jones, chairman. W. H. Ellis, general manager.
Chesterfield	Councillor H. Cropper, vice-chairman. R. H. Campion, general manager.
Coventry	Councillor H. W. Wale, chairman. Councillor J. Grant, vice-chairman. T. R. Whitehead, general manager.
Croydon	Councillor A. A. Thomson, chairman. T. B. Goodyer, manager.
Darwen	Councillor G. Butterworth, vice-chairman. G. A. Newsome, engineer and manager.
Dundee	Councillor A. Malcolm, convener. W. T. Young, general manager.
Edinburgh	Councillor W. L. Sleigh, convener. R. S. Pilcher, general manager.
Exeter	R. O. Baldwin, general manager.
Halifax	Alderman A. Fawcett, chairman. Councillor A. Broadley, vice-chairman. J. W. Galloway, tramways engineer.
Huddersfield	Councillor E. H. Sellers, chairman. Councillor T. Canby, vice-chairman. A. A. Blackburn, general manager.
Hull	Councillor A. Digby Willoughby (sheriff), chairman. Councillor R. Richardson, vice-chairman. E. S. Rayner, general manager.
Ilford	Councillor G. R. Davey (chairman of Council). L. E. Harvey, manager and engineer.
Keighley	Councillor A. Smith, chairman. Harry Webber, general manager.
Lancaster	Councillor T. Wilkinson, chairman. J. B. Patterson, manager.
Leeds	J. B. Hamilton, general manager.
Leith	F. A. Fitzpayne, general manager.
Leyton	Councillor C. W. Daines. F. Schofield, manager.
Liverpool	Alderman F. Smith, vice-chairman. Councillor W. J. Bailes. Councillor J. Gordon. Councillor J. H. Naylor P. Priestly, general manager.
London C.C.	Councillor W. J. Squires, chairman. A. L. C. Fell, general manager.
Lowestoft	H. H. Saunders, general manager.
Maidstone	Alderman D. T. J. Lyle, chairman. A. T. Lambert, general manager.
Manchester	Alderman J. Bowes, chairman. Alderman A. W. Chapman, vice-chairman. J. M. McElroy, general manager.
Nelson	G. F. Nayler, manager and engineer.
Newcastle-on-Tyne	Alderman R. Mayne (sheriff), chairman. Councillor Wm. Bramble.
Newport (Mon.)	N. J. Young, general manager.
Northampton	Councillor T. D. Lewis, chairman. J. T. Cameron, general manager.
Oldham	Councillor J. K. Cheetham, chairman. Alderman W. Stanbury, vice-chairman. W. Chamberlain, general manager.
Perth	Councillor A. W. Fisher, convener. W. G. Snell, manager.
Plymouth	Councillor J. Hayne-Pillar, chairman. Councillor W. H. Welsford. H. P. Stokes, engineer and manager.
Pontypridd	Councillor M. L. Jones, chairman. J. E. Teasdel, engineer and manager.
Portsmouth	Councillor J. Timpson (Mayor), chairman. Councillor W. Gleave, vice-chairman. W. R. Spaven, general manager.
Preston	Alderman J. Ormrod, vice-chairman. J. F. Simpson, engineer and manager.
Rawtenstall	C. L. E. Stewart, general manager.
Reading	Alderman C. G. Field, chairman. J. M. Calder, general manager.
Rochdale	Alderman J. Taylor, chairman. Geo. Webster, general manager.
Rotherham	T. P. Sykes, general manager.
Salford	Alderman H. Linsley, chairman. G. W. Holford, general manager.
Sheffield	Alderman W. C. Fenton, vice-chairman. Alderman J. Knowles. A. R. Fearnley, general manager.
Southampton	Alderman F. A. Dunsford, chairman. J. Dobson, manager and engineer.
Southport	Councillor E. Clayton, chairman. Alderman J. Richardson, vice-chairman. T. J. Kendrew, general manager.
South Shields	Councillor J. G. Winskell, vice-chairman. J. C. Whiteley, general manager.
Stalybridge	Councillor W. H. Rhodes, vice-chairman. Frank Schofield, commercial manager.
St. Helens	Councillor A. Rudd, chairman. Councillor T. Abbott, vice-chairman. L. C. Bellamy, general manager.
Stockport	Councillor T. W. Potts, chairman. A. T. Eardley, general manager.
Sunderland	Alderman Geo. New, chairman.
Swindon	Alderman G. H. Stevens, chairman. T. Medcalf, manager.
Wallasey	Colonel R. R. Greene, general manager.
Walsall	Alderman J. Cope, chairman. Alderman J. Williams, vice-chairman. C. Burgess, general manager.
Walthamstow	Councillor J. W. West, chairman. William Murray, manager.
Warrington	Councillor P. Delaney. Councillor P. Plinston.
West Ham	Alderman W. Devenay, Mayor. Councillor G. Croot, chairman. L. Slattery, general manager.
West Hartlepool	T. G. Richardson, general manager.
Wigan	Councillor J. Walkden, Mayor. Councillor A. Guest, chairman. B. Hall, general manager.
Wolverhampton	C. Owen Silvers, general manager.

J. BECKETT, *General Secretary.*

Others present included Messrs. H. M. Todd (president of the Public Ownership Association of America), C. G. Tegetmeier (chairman of the Tramways and Light Railways Association), A. H. Allen, R. G. Cunliffe, W. E. Freir, H. E. Townell, and A. M. Willcox.

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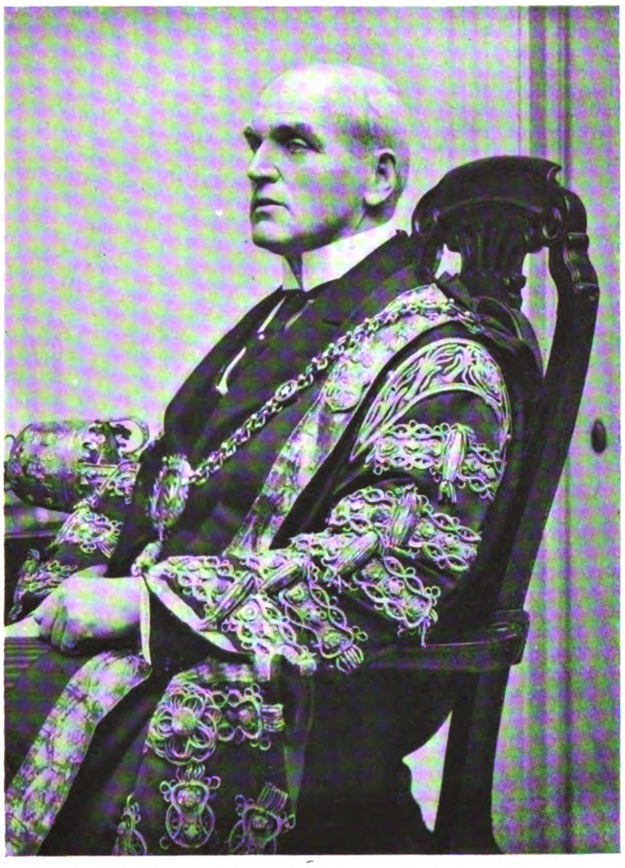
OPENING SESSION.

RECEPTION BY THE LORD MAYOR OF CARDIFF.

The nineteenth annual conference of the Municipal Tramways Association (Incorporated) was held at Cardiff from September 15 to 17, 1920. At 10.30 on Wednesday morning, September 15, the delegates to the conference and a large number of ladies who accompanied them were received in the Council Chamber at the Cardiff City Hall by the Lord Mayor of Cardiff (Councillor G. F. Forsdike).

The Lord Mayor, in welcoming the Association, said—Ladies and gentlemen—It is a very sincere pleasure this morning to extend a welcome to you on your visit to Cardiff to hold your nineteenth annual conference. I am bound to say that the average member of a local authority has little idea of the Municipal Tramways Association, and although I am a member of the Electric Light and Tramways Committee in Cardiff, and I occupy the very exalted position of Lord Mayor, I, in common with most of my colleagues, up till a week ago knew very little of your work and activities. But, ladies and gentlemen, that I have corrected, and at present



The Lord Mayor of Cardiff (Councillor G. F. Forsdike).

I am prepared to hold forth upon the work of your Association even as well as Mr. Beckett himself. (Laughter.) I want to tell you that we in Cardiff always welcome very sincerely the visits of important bodies carrying on public work such as yours. We think that it speaks well for the position of Cardiff among the larger cities of our kingdom that so many important bodies have this year—and, indeed, each year—chosen Cardiff for their meeting place. Your particular body is in its nineteenth year, and although I have not the advantage of the records of your work during that period, I see by the agenda of the work which was done during last year that its work is of an exceedingly important character. But we, as local authorities, as citizens, as taxpayers and as ratepayers, even the humblest of us, are facing problems to-day that our forefathers never dreamed of; and, indeed, it is a truism to say, I think, that we now have more problems to face in a day than they contemplated in a year. (Hear, hear.) This has been brought about by circumstances which we have not been able to control, and these trying conditions, and these serious problems demand from all of us a different outlook from that which we affected towards public and business affairs in 1914. (Hear, hear.) We in Cardiff, as you probably know—because we are not so obscure that when we have a strike here they do not know of it in other parts of the kingdom—have gone through quite recently rather serious trouble in the particular department with which your body deals. I am glad to say that we have got over that fence successfully—for the moment. (Laughter.) But I am full of optimism, gentlemen, that not only those who conduct the tramway services in the various cities—the members of the various committees—but also the men and their leaders will take a proper and, may I say, a saner, view of their responsibilities in the future. (Hear, hear.) I am not here to say, with reference to our own particular strike, that this person or that body is blameworthy. Everything has so changed that it is very difficult to allocate blame; but it is to be said for the leaders of the men in Cardiff that after discussion, and after the fullest possible light had been thrown on all the information there was, they advised their men to adopt a certain course. We feel that the Industrial Councils that have been set up to deal with conditions of service, wages, hours, and so forth are the machinery which, if properly worked, if conscientiously worked from both sides—the leaders of the men as well as the committee members of the Corporations (the members from the employing side upon these Industrial Councils) will provide a solution of these difficulties. If both sides sit down with a single eye to arrive at an honest and fair decision then a solution will be reached. If there is an anxiety on the part of the men to crush the committee and to boast that they have defeated the local authority, or on the other hand, on the part of the local authority to say that they have crushed the men, that is a hopelessly rotten spirit—(hear, hear, and applause)—and I do think, from the limited experience I personally have had in connection with that strike, that the further we get away from the horrors of the war, the further we leave them behind, the better shall we settle down to what I call somewhat normal conditions. We are living very, very near to the war and all its horrors at the moment, and it is very difficult indeed for men's minds to settle down to a saner state of things; but it is coming, and I am one of those in public life who feel optimistic for the future. There are black clouds—industrial clouds—overhanging us at the moment, but I am optimistic enough to think that they will pass away, and that we are not going to have this awful catastrophe which threatens us. I want to say to you, gentlemen, who carry on the work of the Association, that if your Cardiff visit can be marked, as I hope it may be, by a distinct step forward in your work, then you will feel that it has not only been a happy visit from the point of view of the good folk of Cardiff as entertainers, but that it has been a noteworthy visit from the point of view of your activities. If that is so, then we in Cardiff shall be very pleased; and, finally, ladies and gentlemen, if you receive from your visit to Cardiff one-tenth part of the pleasure which we in Cardiff have in entertaining and receiving you, then we shall all go away satisfied. (Applause.)

Alderman Sir John W. Courtis, Kt., J.P. (president of the Association).—My Lord Mayor, ladies and gentlemen—It is my pleasure, as the president of the Association, to thank you on behalf of the Association for the very kind reception which you have given to the members of it to-day. I am quite sure all those present have listened with much interest to what you have said with regard to the industrial situation. (Hear, hear.) We have gone through some troubles in Cardiff lately, and the Lord Mayor has suggested another trouble that is facing us at the present time. I hope with him, and I am sure you all do, that the heavy clouds which threaten us will pass away, and that we shall not have that catastrophe which is at present threatening us. In this district we shall feel it as much, if not more, than any other district, because just outside Cardiff is a great mining area. Therefore we hope and trust that this terrible trouble will be averted. In welcoming you, the Lord Mayor did not say anything about the weather of Cardiff, and therefore may I say on your behalf that we arranged this little shower this morning in order to lay the dust. It was rather a trouble yesterday. There was a little dust, and the Lord Mayor, with his usual habit of doing everything perfectly, arranged for this shower of rain. He has also arranged that amongst the other attractions of Cardiff you should have a horse show, one of the finest horse shows, I believe, in the kingdom, to synchronise with your visit. That, however, must be more an attraction for the ladies, because the gentlemen will attend to their duties in the conference—(laughter)—and carry on, as the Lord Mayor said, the useful work which the Association has always done. I thank you once more, my Lord Mayor, on behalf of the Association for your very kind reception.

The Lord Mayor.—Ladies and gentlemen, there was no necessity for the vote of thanks, but I am glad of it because it enables me to say this also, which I omitted before. I do not know how many of you have visited Cardiff before, but lots of people who come to Cardiff think they are coming to the Black Hole of Calcutta. Indeed, I have heard a distinguished scientist say that they expected to find coal-pits in the middle of our streets. (Laughter.) Just this final word, ladies and gentlemen; you have come to the most beautiful and cleanest city in the Empire. (Loud laughter.)

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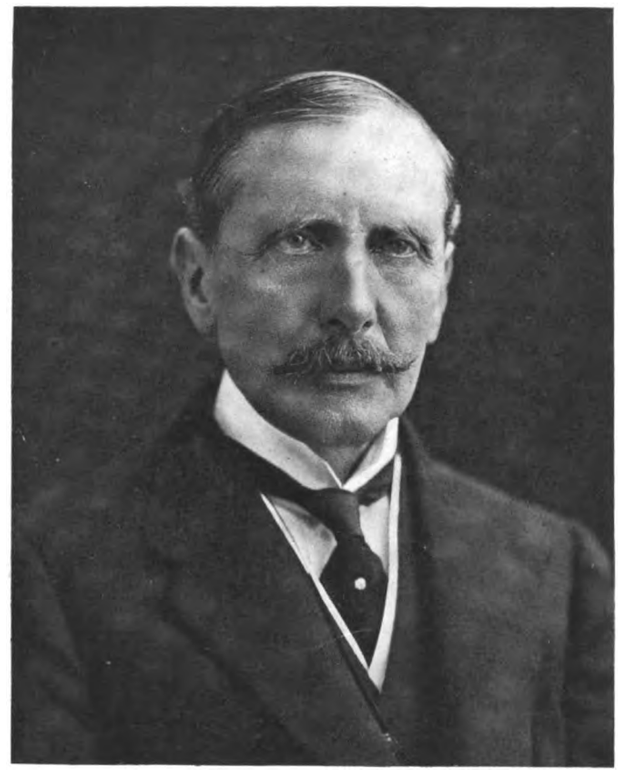
PRESIDENTIAL ADDRESS.

By SIR JOHN W. COURTIS, Kt., J.P.
(*Chairman of the Tramways Committee of the City of Cardiff*).

Gentlemen of the Association,—My first duty this morning is to extend to you, as the representatives of the municipal tramways in this kingdom, a most cordial welcome to the commercial capital of the Principality, both on my own behalf and that of the Tramways Committee of this city. We hope that your visit will serve the two-fold purpose of promoting, in some measure, the general interests of the tramways industry, and at the same time afford you a brief respite from the unexampled stress and anxiety that have followed in the wake of the war.

Let me remind you that your visit here synchronises with the 50th anniversary of the establishment, by a Public Act of Parliament, of tramways in this country. The Tramways Act of 1870 bears some marks of the hesitation of Parliament in consenting to the municipal ownership of tramways. Its limitations are clearly defined. Indeed, it was restrictive to the point of expressly forbidding the municipal operation of them. Nothing in that Act was to "authorise any local authority to place or run carriages upon such tramways and demand and take tolls and charges in respect of the use of such carriages." The intention of Parliament was that local authorities should construct the permanent way, and raise the capital for that purpose, then forthwith lease them to private enterprise. It was not until twelve years later that the barrier to operating them was first removed by Private Bill legislation. In 1882 the Huddersfield Corporation obtained an Act authorising them to operate their own tramways if they failed to find a lessee with whom they could arrange satisfactory terms, and then only upon a licence from the Board of Trade.



Sir John W. Courtis, J.P.,
President Municipal Tramways Association.

During the intervening 38 years we have travelled far. We have been able to learn from each others' experience what to adopt and what to avoid. It was a happy suggestion which, in 1902, first brought this Association into existence, and thus provided means of bringing each others' experience into the common stock for mutual advantage. We now include almost every municipally owned tramway undertaking in our membership.

Within the past half century £79,000,000 have been expended in this country in tramways construction and development. Of that sum £54,000,000 have been incurred by local authorities. The Ministry of Transport recently prepared an interesting return on the growth of tramways and their passengers, in which it is pointed out that since 1878 the length of the route open for public traffic in the United Kingdom has increased from 269 miles to 2,728 miles in 1918-19. Of the last-named distance 1,713 miles were owned and worked by local authorities, and 146 miles owned by local authorities were worked by companies. The mileage worked by electric traction was 2,660, or 97·5 per cent. of the total.

Compared with the last completed year prior to the war (1913-14), the total number of passengers carried has risen from 3,426,473,192 to 4,557,640,078 in 1918-19, an increase of 1,131,166,886, or 33 per cent. In the same period the number of car-miles run has decreased from 354,379,672 to 320,378,376, with the result that the average numbers of passengers per car-mile is now 14·2 as compared with 9·7 in the year 1913-14. The number of journeys per head of the estimated civil population works out at 108 as compared with 74 in the year 1913-14; whilst the number of passengers carried per mile of route open was 1,668,122, an increase of 400,387, or 31·6 per cent. on the pre-war figure.

The number of local authorities who have obtained powers in connection with railless trolley undertakings is 26, and of these only seven actually carried passengers. Of the total, five companies have also obtained powers, of which only one was operated during 1918.

Nor have we yet completed our work by any means. The progressive conditions under which we live demand that we shall provide ample transport facilities for enabling the great industrial populations of our towns to spread themselves out over wider areas, and so relieve the density and over-crowding of populations within relatively small districts. In my opinion tramways committees have yet a large part to play in that direction, and by so doing share in the beneficent work of health committees. Whatever form these facilities may take, whether by tramways, trackless trolley systems, or motor omnibus, can be decided only by experience. In the meantime tramways hold the field where large numbers are concerned.

Whatever form of road transport may exist, or may emerge from future experiments, the first and paramount condition must be that in this purely commercial sphere the passenger must pay for his passage. The man who does not travel should not, in equity, pay any part of the fare of the man who does. That general proposition is not seriously contested anywhere, I think. It is manifestly the only sound policy to apply to a public service which is made use of optionally by the community.

This conference will be devoted almost wholly to the consideration of the financial side of municipal tramways. The stage we have now reached, and the times through which we are passing, demand from the conference a full survey of that field, and the adoption of measures to put our house in order. It is not necessary for me, in the face of the programme, to bring under review the existing conditions. That will be done in some detail by those who follow me. I will remark, however, that many authorities have been recently struggling in the vain attempt to meet post-war costs out of pre-war fares.

Increases in fares on tramways have become as much a necessity as the increase in the price of any other commodity, but it has been reserved for tramways, almost alone among public utility services, to encounter an unreasoning opposition to the common custom and economic necessity of handing on the increased cost to the consumer. My submission is that it is not our business, as the administrators of a great industry, to sell a ride to anyone, either resident or non-resident, at less than cost price. The accounts of almost all our undertakings for 1919-20 have brought home to the community the sharp reminder that we have been doing so during the past year

It is the opposition to which I have referred that has been the greatest stumbling block in the path of the National Council in dealing with the wages question, which has absorbed most of the time of that body since it was constituted in September, 1919. Limited by statute in our charging capacity, and opposed by public sentiment to increased fares, the finances of the industry have drifted into a state of difficulty, and of some danger to our stability. I am sure that you will agree with me that our first and foremost duty to-day is to endeavour to awaken the public mind to the absolute necessity for increased revenue, unless indeed we must abandon our stewardship, drift helplessly along into jeopardy and chaos, and stand by indifferent to the arrested progress of the industry which is our special care. By all means let the employees have adequate wages for their services, but by all means likewise let the users of tramways recognise the resultant demands upon them.

You will recollect that part of the time of last year's conference in Dundee was occupied in considering the arrangements for dealing

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with the application made in July, 1919, for further increase in wages.

Immediately after that conference the Interim Court of Arbitration conducted an inquiry in London, Bristol, Glasgow, and Manchester, and heard the evidence of every tramway authority that wished to appear before them. They heard, in fact, the representatives of 37 municipal tramways in the course of their investigations.

A full report of those proceedings was prepared, and promptly issued to all the members of the Association, so that I need not further refer to them.

Up to and including the award following the inquiry, the war bonuses granted nationally were—

	Amount of award per week.
By the Committee on Production—	£ s. d.
March 8, 1918	1 0 0
July 9, 1918	0 5 0
Nov. 21, 1918	0 5 0
	1 10 0
and by the Interim Court of Arbitration—	
October 7, 1919	0 4 0
A total of	£1 14 0

The further application made during the year has been dealt with by the National Council, and the result you all know.

The National Industrial Councils with their constituent District Councils, are a new and distinctive instrument in the commercial life of the nation. They mark a new departure in our endeavours to secure a continuity of industrial peace. They occupy a position of the first importance in our attempts to find a solution for the most pressing problem of our time.

Their early career and progress will therefore be watched with great interest and concern. In experimenting with a new order of things they will make mistakes, and be criticised no doubt. To these organisations both time and patience must be granted in their youth. We need not be surprised if they encounter some difficulty in the field of finance, where interests clash the most. They exist not only for wages questions, but to promote the general well-being of the industry, and if a tribunal composed of representatives of the entire public on one side, and a section of the public engaged in operating this monopoly service on the other, can hold an even balance, and find solutions of their differences by common agreement as a result of an appeal to reason, and thereby put an end to the dislocation, by strikes and conflicts, of a necessary service, they will, in my opinion, deserve well of the community.

The outstanding achievement of the National Council is the passing of the Tramways (Temporary Increase in Charges) Act, 1920, arising out of an investigation of the tramways budgets for the current year. It is for us to use that Act to the extent of making tramways generally self-supporting. The National Council have also rendered not a little service, through the standing committee, in a number of questions which affect us all in common. These have been reported upon to you from time to time. Some pressing questions are yet awaiting settlement, and the programme for 1920-21 is likely to be well filled.

Other subjects will occupy the attention of this conference. The question of the rating of tramways that now make no profit upon pre-war earnings will, I hope, be considered. The burden of road maintenance, constantly added to by reason of heavy commercial vehicle transport, is ripe for adjustment. The appropriation of the proceeds from the taxation of mechanically-propelled vehicles is one that has occupied the attention of the Executive Council during the year. The claim of tramways authorities to share in the yield of such taxation is irresistible in these days of electric traction. It is our bounden duty to press that claim.

Again, the question of rate-aid from tramways must be considered. No sanction to increase fares under the Act of 1920 will be granted for the purpose of producing profits to be applied in reduction of direct local taxation. The obvious corollary is that under normal conditions no money must be taken from the rates to subsidise tramways. Self-support should be the watchword.

After very exhaustive investigations and experiments, and numerous meetings extending over four years, the Special Committee on the standardisation of overhead line material has been able to present a most interesting and valuable report, together with specifications and drawings. These are referred to in the report of the Executive Council.

Just in a word I venture to emphasise the request that the report should be generally adopted, and the results of the committee's work become the Municipal Tramways Association's standards. The existing diversity in overhead equipment is shown to be both cumbrous and expensive. The need for such diversity no longer exists. Nothing need be scrapped before the end of its useful life. The suggestion of the committee has been adopted by the Executive Council that a standing committee should be appointed to which all questions of further improvements may be referred from time to time lest we merely stagnate at the point now reached. The existing members have been asked to constitute that committee and to report upon the progress made in adopting the new standards.

I am sure I shall express your feelings, as I do my own, in conveying to those gentlemen the thanks of the Association for the excellent results they have achieved.

This Association is greatly indebted to those gentlemen who have served on the National Council as your representatives. They have sat through many very long meetings at the Ministry of Labour during the year, in order that the Council should discharge its primary function of determining questions submitted to them, after full discussion, without the aid of an independent chairman from outside.

I need not detain you upon the work of the Executive Council during the year. It is set out in their report. It is their regret that it was found impossible to obtain offices in London during the year, and consequently the secretarial work of the Association has been conducted under somewhat difficult and trying conditions. The general secretary is under great obligation to a number of members for the generous assistance accorded to him throughout the year.

In this connection I should like to be permitted to pay my tribute to the excellent manner in which Mr. Beckett has discharged his duties during his first year of office. He has had an exceptionally busy year, and he has thrown himself into his work with that energy and ability which the Executive Council are familiar with. To mark their appreciation of his services, your Executive have specially recognised them in a material form—a fact which, I am sure, you will be pleased to learn, and with which you will no doubt agree.

For myself, I have found the demands upon my time by the National Council especially to be heavy. On the Executive Council I have received from my colleagues every possible assistance. We have all striven during the year to serve with a single eye the best interests of the Association, and through the Association that of all its members. I hope that this conference may be as useful and successful as any of its eighteen predecessors.

The President.—It is now proposed that we adjourn to the conference room, where the papers will be read and the further business transacted.

When the delegates met in the conference room for the reading and discussion of papers,

Mr. G. W. Holford (vice-president) said—There is one little duty which we failed to perform in the other room, and that was to tender a hearty vote of thanks to our president for his very excellent address. I have very great pleasure in moving that our sincere thanks be tendered to our president.

Councillor W. J. Squires (London County Council).—I rise with very great pleasure indeed to second the vote of thanks to the president for his address to us this morning. In my opinion it contains a great deal for us to think of in the future. The reference he has made to what the Association has been doing, I think, is perfectly true; and no doubt before we leave Cardiff he and we will find that there is a great deal more that we shall have to tackle before we solve the questions that are before us. I have very great pleasure in seconding the vote of thanks.

The vote of thanks was then carried with acclamation.

The President.—I thank you very much for your kind vote of thanks, and if my address has been appreciated I am amply rewarded. The first business is to hear a paper by Councillor Higham, and I have much pleasure in asking him to read it.

Councillor C. Higham (chairman of the Blackburn Corporation Tramways Committee).—It is with great trepidation that I come before you this morning to read this little paper, and to introduce what I think is the main object of our convention this year, and that is the study of finance and the question of fares. I have ventured to state at the beginning of my paper that it is the most important subject we have to consider because it is from fares that we derive the greater portion of our income. In the past many undertakings have been in a difficulty to know what to do with their surplus, but I do not think that will be the case in the future if the present state of things continues.

Alderman F. Smith (vice-chairman, Liverpool Electricity and Tramways Committee).—May I ask Councillor Higham whether he confines his observations in his paper with regard to the "milch cow" to contributions to rates, or does he carry it further?

The President.—I think Councillor Higham will reply to questions at the end of the discussion rather than to each speaker individually. Mr. Priestly's paper is on the same subject, and I think it would be better to have that paper read and then discuss the two together.

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TRAMWAYS FARES.

By Councillor C. HIGHAM
(*Chairman, Blackburn Corporation Tramways Committee*).

The short paper I have to present to you deals with the most important subject there is in connection with tramway undertakings.

Postulate that tramway undertakings have to pay their way, and not be a burden upon the rates, then a proper adjustment of fares to meet the enormous increases in expenditure is essential. Wages and cost of materials have increased out of all proportion to the fares we have been charging, and unfortunately we are not able to hand on to our patrons the increases in the cost of producing rides (which is the commodity we sell) with the same facility as other industries. For instance, when the cost of producing food, clothing, and other commodities increases it can be at once passed on to the customer almost without delay, as with Budget duties. With a tramway undertaking we have, first of all, to convince the committee of the necessity of an increase; then we have to face the Council; and after that a storm of abuse in the shape of letters to the local press, protest meetings, etc., etc., wherein it is always clearly shown that the proper way to increase revenue is to reduce fares instead of increasing them, and to lengthen stages in lieu of

Councillor C. Higham.

shortening them, until you are almost forced to the conclusion that the people to manage tramway undertakings most efficiently are those who never had any experience of them, and that if you only reduce fares to the vanishing point you will have ample revenue to meet all your obligations.

That is not quite the advice I am going to offer you to-day. I am not one of those who believe that tramways should be the milch cow for paying the rates of the district, but I am firmly of the opinion that they should pay their way, that the riders should pay for their rides, and with that end in view every authority should adjust its fares to keep pace with the constantly increasing cost of labour, material, and money, and similarly when the process is reversed.

In most towns the time has arrived for the abolition of the penny fare. Whilst this fare may still be possible in some large cities, I think the time has long passed when it could be termed a sound economic fare in the majority of cases.

The first mile of your tramways from the centre of the system is in general the distance you have to depend upon most to make the undertaking a success. If the people who use this portion are to escape all the increases in cost, how can you expect to get the necessary revenue out of those who travel the longer distances, especially in view of the fact that in rush times you are most liable to have your cars crowded with penny fares to the exclusion of longer distance passengers, and when these lower fares have quitted, you are very often left with a car load of wind to the end of the route? Then, again, it is scarcely just that the passenger who only needs the car for a short journey should escape the whole of the increased cost, leaving the people who require a longer ride to bear the whole of the burden.

Then we have the question of "workmen's" fares. In view of the present position should these be continued? This is a very important point, because I think it will be generally conceded that a "workman's" fare is not a sound economic fare, and if this is the case then part of the cost of carrying such "workmen" must be borne by someone else. I don't think anyone can argue that this is a fair, equitable, or rational state of things to obtain. When we had large classes of workmen receiving miserably low wages, there may have been some reason for subsidising the carrying of those who had to use the cars to get to their work, but now, if the amount of wages has to be taken into consideration, then it is not the people who go to work before 8.0 a.m. who should have half fares, but those who in the past have been looked upon as the aristocracy of labour, and go to their daily toil at 8.30 or 9.0 a.m. But I am firmly of opinion that there should be no subsidised fares for any class.

I see no reason why the tramway undertaking should be looked upon as a charitable institution any more than any other municipal undertaking. Whilst we have workmen's fares I have yet to find, or even hear, of a demand for workmen's rates for gas or electricity charges. We have also demands to carry the blind, nurses, and others entirely free, but one never hears of the same demands being made on other departments of Corporation activity. Now, if it is logical that tramways should be used by some classes at cheaper rates than others, or entirely free, it is equally logical to ask for free gas, free electricity, and so on.

Tramways authorities have to go into the same markets for labour, material, etc., and if a tramways undertaking is not a success, it receives quite as much criticism and blame as any other public department. Therefore I see no valid reason whatever why we should be looked upon as the Cinderella of municipal undertakings.

TRAMWAYS FARES.

By P. PRIESTLY
(*General Manager, Liverpool Corporation Tramways*).

In adopting the suggestion of the Executive Council that I should give a short paper on "Tramway Fares," I am faced with some difficulty in introducing new points, as the question of fares is one which, I think you will agree, has been thoroughly thrashed out in recent times, and every committee and tramway manager has perforce gone into the question of revising the fares to meet the ever-increasing expenditure.

The general question of tramway fares may be sub-divided into—

(*a*) Fares for ordinary passengers.

(*b*) Fares for workmen, children's fares, etc.

Consideration should also be given to the question of issuing contracts, transfers, etc.

In dealing with the ordinary passenger fares, the rate stipulated in the Acts of Parliament prior to 1914 was usually fixed at 1d. per mile, but the operating costs have increased to such an extent that many towns have had to obtain powers to increase the statutory fare from 1d. to 1½d. per mile, and in some cases to 2d. per mile. The majority of the larger undertakings which, prior to 1914, were not charging their full statutory fares, have found that it is impossible to make their tramway systems self-supporting unless the full statutory fares are charged. Each town must, of course, be its own tribunal in this matter, owing to the diversity in local circumstances.

The first consideration in connection with the operation of a tramways undertaking is that it should be run on a commercial basis; that it should produce an adequate financial return to the municipality to provide the community with a full service; and that it should accumulate sufficient funds for the renewal of the undertaking, as well as its improvement and extension. It is clear that for a system to be remunerative the fares to be charged must be such as will bring in sufficient revenue to cover the whole of the costs, including capital charges, operating costs, renewals, etc. The fares charged ought to be laid out on an equitable basis, i.e., each passenger should pay his share of the sum of the different items of expenditure.

The scale of fares charged will also depend upon the density of the population, and upon how often the residents can be induced to travel. One method is to arrange fares on a definite distance for the basic fare, and to charge the higher fares for the longer distances on this basis. Another method is for a high minimum and a low maximum fare to be adopted, which means that the short-distance passengers pay a much higher average fare than the long-distance passengers. This is of great importance in making a

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tramways undertaking of the greatest service to the community. It encourages people to live at longer distances from their work, and in healthier surroundings. It also tends to spread the population more evenly over the tramways system, and to diminish somewhat the tendency of the population to gravitate to the centre of a town and cause congestion, with the result that the long-distance passenger is often crowded out by the short-distance rider. For these reasons I am not in favour of giving short rides at low fares in the centre of the town.

In the United States and Canada it has been found that a flat rate for any distance has not been altogether successful, and the question of adopting a grading fare system is receiving the consideration of many of the authorities in the States and Dominions.

Having regard to the present high operating costs, it will be agreed that passengers cannot now be carried anything like the distance for the same fare as was the practice prior to 1914. After carefully considering the matter, I have arrived at the conclusion that the best method is to take a central point of the tramways undertaking as the town terminus, and from that point to divide the system into mile zones. It must then be ascertained at what cost a passenger can be carried for a mile, which amount must cover all charges in so carrying the passenger, or, in other words, each passenger must pay the full cost of his ride. In some towns this amount has been found to be 1d. per mile, whilst other towns have had to make a minimum charge of 1½d. per mile. Consideration

Mr. P. Priestly.

should, of course, be given to the best traffic point nearest to the mile distance, so that in some cases it might be a little more or a little less than a mile.

This I consider is the best and most equitable basis upon which to arrange a system of fares, but it might be found that some advantage could be gained by charging a slightly lower fare to the long-distance passenger, in which case the first zone would be a mile, and the next stages could be slightly increased in distance, so that passengers from, say, a five-mile radius would be able to travel to the central terminus for, say, a 4d. fare.

It might be asked why the longest distance passengers should be given the advantage of a cheaper ride. The area served by the undertaking will in future have to be extended, as towns are bound to spread out over wider areas in the future under the Government housing scheme of twelve houses to the acre, and I consider that the passenger who travels on a tramway system for the whole of the distance should be given some advantage, as the running costs per car-mile are less as the car reaches the less thickly populated districts, when there are fewer stops, and the speed is increased, so that whilst the standing charges remain practically the same per passenger, the running costs decrease slightly, making the total charge per passenger slightly less, and therefore a lower fare can be charged. It will also be recognised that these outside areas serve as feeders to the main system, and in course of time, when the districts are fully developed, become amongst the best paying portions.

I have endeavoured, in suggesting this method, to avoid multiplicity of stages and tickets, and to simplify as far as possible the work of the conductors, and also to obviate complaints from passengers that they do not know how far they can travel, or what the correct fare is. I think that the time has gone by when consideration should be given to splitting stages, i.e., 1½d., 2½d., etc., fares, as these give rise to considerable difficulties in the collection of fares, and also give opportunities for passengers to avoid paying the correct fares, and therefore they often travel a longer distance than they are entitled to, besides adding to the number of tickets which the conductor has to deal with. The question may be raised as to overlapping stages. I am not generally in favour of these, except between the first and second 1d. stages, which do not extend outside the city area. These overlapping stages often encourage the business people to use the cars wherever they may be going within the business area.

With regard to the granting of special privileges, under which heading I have placed workmen's fares, children's fares, etc., I am entirely against the principle. Where cheap fares have been adopted the passengers having such privileges usually travel during the rush hours of traffic, and I think that it is entirely wrong in principle that one class of passenger should have cheap fares at the expense of the other passengers.

Committees are often asked to issue contract tickets, etc., at reduced rates, the sole object of those who want such privileges being to obtain a rebate on the ordinary fares.

Contract tickets are unworkable on a tramway system, and wherever these privileges have been introduced they have been in general abused, and, as before stated, I am of opinion that the granting of any privileges is wrong in principle. I consider that no preferential treatment should be given to any class of passenger. I am rather in favour of a system of higher fares being charged on special occasions, such as race meetings, football matches, etc., as I consider that a large number of the people attending such meetings are strangers to the town, and only come there for that special purpose. They should therefore be charged higher fares in consideration of special cars having to be provided for their convenience.

I consider that, if it were practicable, non-residents should be charged a higher fare, as they are under no obligation to meet any deficit which may arise from the operation of the tramways undertaking.

I am entirely against the adoption of the transfer system, which is difficult to work, and even when put into operation has proved to be unsatisfactory. I have not given any consideration in this paper to the question of ½d. fares. I think that we shall all agree that the present operating costs make the serious consideration of the adoption of halfpenny fares impossible.

In conclusion I must repeat that the adoption of any scale of fares must be based on the assumption that they will cover all capital charges, operating costs, renewals, etc., and it is only when such a system is adopted, and all special privileges withdrawn, that tramway undertakings will be placed on a sound commercial and defensible financial footing.

DISCUSSION.

The President.—I am now prepared to hear anybody who wishes to discuss the papers we have just heard.

Alderman F. Smith (vice-chairman, Liverpool Corporation Electricity and Tramways Committee).—I do not think I should have felt called on to make any observations on Councillor Higham's paper were it not for the fact that he has once again disinterred that whiskered and venerable phrase, "the milch cow." (Laughter.) I understand from his observations that by the milch cow he means that you should give nothing to the proprietor of the undertaking. If any gentleman here was the owner of a tramway undertaking, and his manager told him that he could have nothing from it, I think he would pin on his bosom the noble order of the sack—(laughter)—and if there was a gentleman in Liverpool who held the view which has been expressed by Mr. Higham, I would take care that he had an opponent at his very next election. Why do I say this? I will tell you. Tramways operated by mechanical traction are of very recent growth. The roadways were made by the ratepayers who are still living, and the ratepayers who paid for those roads are entitled to a fair contribution from the tramway undertaking, such a contribution as would be paid if you granted a monopoly of such roads to an outside person. That contribution ought to go to the relief of the rates, and for the reason that there are many people in our towns who (themselves and their families) do not use the tramways. There are, on the other hand, many people who come into our towns, and particularly a town like Liverpool, who—as Mr. Priestly has rightly said—do not care, because they only come in occasionally, whether our tramways pay or not. Therefore I venture respectfully to submit to you, gentlemen, that it is a proper thing for a reasonable and proper amount to be set aside and conveyed to the ratepayers, so that nobody shall be subsidised by anybody else. Councillor Higham is inconsistent. He claims that no subsidy should be paid, and yet he wants roads

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provided by people long ago to be given over to the free use of the tramways, and that no contribution should be made to the rates in respect of their user. I do not agree with that, and I have often heard tramway managers hold forth on the same lines, but if that tramway manager was in an undertaking where I had any power I should endeavour to put him in second place, and put a man at the head of the job who understood that all portions of the city must be represented by a gentleman who had the ability to run the tramway service properly. (Laughter.) Councillor Higham says, "Look at the subsidies," and he speaks of the milch cow. He has also mentioned subsidies for the poor rate. If anyone will look at his poor-rate bill to-day he will see that it is twice or three times as much as it was a very few years ago, because there are subsidies given for education and for other purposes. Then he says that cheaper electricity is not asked for. Let him come to Liverpool where there is a new housing scheme—(laughter)—and see what is required from the Liverpool electric lighting committee to provide electric light for the workmen's dwellings that are being put up. He will widen his experience if he does. (Renewed laughter.) He also says that the trouble has been that tramway authorities have not known what to do with their surplus. I have never recognised that.

Councillor Higham.—No, you do not.

Alderman Smith.—There are enough claimants for any tramway surplus you can possibly have. In dealing with the various questions relating to tramways and their management, Councillor Higham has well said that there are thousands of managers among the public who can tell you how to run your tramways. They wave their hands and show you exactly how it can be done. (Loud laughter.) Our chairman once had the good sense to take one of these gentlemen down to the pier head and let him manage the tramways for an hour or so. (Laughter.) Some of the people on that particular Saturday night did not get home until one o'clock Sunday morning. (Laughter.) The fact is that tramways are not to be run by a wave of the hand in the Council. They require careful study of what should be, can be, and ought properly to be done. I am not going to criticise Mr. Priestly's paper here to-day—(laughter and "Oh")—but I am going mighty seriously to discuss with him one or two of his points. (Renewed laughter.) I will tell you what it is. You general managers have got a mental squint on this fare question, and if I were to manage a tramway—(boisterous laughter)—I tell you how I should look at it. I should say, "When I came to your city and started to run your tramways your income was so much. I have been running them so long, and now your income is so much. What are you going to give me?" (Roars of laughter.)

Mr. C. Furness (general manager, Blackpool Corporation Tramways).—Mr. President, I rise to a point of order. I have come a long way to this conference to hear something on the question of fares, and if we are going to listen to the sort of discussion that our friend Alderman Smith is giving us, I shall be sorry I came here. If he will leave the question of tramway managers out of it and deal with the question of fares, I shall be pleased to listen to him.

Alderman Smith.—It is the general managers who have to deal with the tramway service. They are the men who have to advise their committees, technically, what to do, and what the committees have to do is to make the undertaking pay, and deal with the proceeds of that undertaking in a fair and just way to everybody concerned in the city.

Mr. W. Murray (manager, Walthamstow Council Tramways).—I should like to apologise for taking such a prominent part in this discussion, because I represent one of the smaller undertakings of the country; but I do so deliberately, because I feel strongly that the difficulties of the smaller undertakings are relatively greater than the difficulties of the larger ones. (Hear, hear.) The larger undertakings have greater possibilities; they have large masses of traffic scattered over long distances from the centre of the system, and they can charge higher fares because, speaking generally, the people must travel these relatively long distances. In the case of the smaller undertakings, however, most of them have short routes; and if we charge too much people might choose to walk, and we would then be in a very serious difficulty. I have listened to the reading of the papers and, indeed, had read them before coming here, with very great interest; and with a great deal, indeed with all that has been said, I am largely in sympathy. In some things, however, I go further than either of the authors of these two papers. Councillor Higham says that the day of the penny fare, in his judgment, in the majority of cases, has gone. Well, I do not think that is so. I had occasion this morning to ride on a Cardiff car for two or three hundred yeards, and I got on expecting to pay a penny; but to my surprise I had to pay 1½d., and I grudged that halfpenny very much. (Loud laughter.)

The President.—You need not have paid anything.

Mr. Murray.—Being a Scotsman, you understand my feelings, and the result was that I walked back. (Renewed laughter.) I consider that the penny is a valuable factor in this fare question, and while I consider that fares have been much too low in the past, so far as systems like my own are concerned, I think we ought to stick to the penny, even if we only give half a mile for it. I think that the only proper basis on which a fare table can be built is the average receipts per car mile divided by the average number of passengers travelling, i.e., if the whole of your costs worked out at 1s. 6d. per mile, and you carry 18 passengers per mile, then the basis of your fare table should be an average of at least one penny per mile. If you carry 24 passengers per car-mile, then the average might be ¾d. per mile; but I think the average fare ought to be equal to the total revenue per car-mile, divided by the number of passengers carried. That is, always assuming that the Council has decided that the system must be run on a commercial basis. Both Councillor Higham and Mr. Priestly think that the short distance passenger should be penalised; and I think Mr. Priestly believes that in the past the short distance passenger has been favoured. That is not so. The short distance passenger has always been penalised—(hear, hear)—and the long distance passenger favoured. Having ascertained your basic rate, I think that if the fare is a penny-a-mile for one mile, it should be 3d. for three miles; and if we want to get on to a proper paying basis to-day, I think our hope lies in increasing the long distance fares. During the war the railways had to adopt that policy when they came upon a time of stress, and the penny-a-mile was charged no matter what the distance. I think that should be very much our attitude towards this question now, viz., to increase the long distance fares. It has seemed grossly unfair to my mind that in the past passengers should be charged ½d. for half a mile and yet passengers 6, 8 and 10 miles have been carried for 2d. It may have been all right at one time, but it will not do to-day. I am assuming, of course, that our Councils wish to make their systems pay their way, but in some cases that is not so. We know that some Councils have decided to charge as low a fare as possible and are quite content to make a deficit and take it out of the rates; and there may be a good deal argued in favour of that policy. It may be necessary in some cases for the well-being and health and happiness of the people, and future development of the district, to carry them outside at as cheap a rate as possible; and if that is necessary or desirable, then it is quite true that the deficit ought to be made up out of the rates. ("No, no.") At the same time I do submit that such a policy can never be satisfactory to the Council concerned, because it lays it open to adverse criticism of all sorts; and most emphatically it cannot be satisfactory to the man in charge of the undertaking, because he is often blamed for the results of a policy to which he is utterly opposed personally. There is one other alternative that I should like to mention, because the majority of undertakings are in a serious position to-day; indeed, I have heard that one undertaking is facing a deficit of over £300,000, and £20,000 and £30,000 deficits are common. If this is to go on year after year there is only one thing to do, and that is to run the tramways free of any charge whatever to the public and put them wholly on the rates. (Cries of "Oh.") Although some of you laugh—and I have done so myself—yet you have been going in that direction in the past. You have already free education, free libraries, free recreation grounds, and free music; and I am inclined to think that in the near future you will be seriously considering the provision of free trams.

Councillor J. H. Naylor (Liverpool Corporation Electricity and Tramways Committee).—I would not have intervened at this stage except for the remarkable speech of the deputy chairman of the Liverpool Tramways Committee, Alderman Smith. One consolation to me is that this conference does not take him seriously. (Laughter.) I say this because he is here.

Alderman Smith.—You are joking. (Laughter.)

Councillor Naylor.—No, I am not joking. In Liverpool our aim in the inception of the tramways was the public convenience. It was never intended that they should be either a milch cow or dependent on the rates for their existence. We, with friends like Alderman Smith, made it into a milch cow, and have taken millions from the profits of the tramways for the relief of rates. To-day, as a consequence of that line of action, we are practically bankrupt. We have neither cars nor equipment—(ironical laughter)—and it is entirely due to the policy of the worthy Alderman. (Laughter and applause.) As has been said by Councillor Higham, you convince members of the tramways committee in committee that it is absolutely necessary to increase fares if the undertaking is to pay its way, but you then find, as has happened in Liverpool, that these men have not the courage of their opinions; they have November staring them in the face. (Laughter.) As one of our colleagues at the last conference said, they are frightened to go before their constituents with these opinions, and yet they were labour men. They called themselves Labour men, God forgive them. (Loud laughter.) A Labour man who is not honest enough to act up to his convictions, and is afraid of being chucked out, ought to be chucked out. (Hear, hear.) I am not going to say that the Labour

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Party is any worse than the Tories, or the Liberals, or the Home Rulers—(laughter)—but to those who are acting on the committees of management of tramway undertakings this is a very serious matter at the present time. No favour ought to be shown to any class of passenger, and we ought not to make large contributions to rates out of the profits of the undertaking which we cannot afford. The proper upkeep of the undertaking ought to be the first consideration.

Councillor A. W. Fisher (chairman, Perth Corporation Tramways Committee).—I should like to raise a question mentioned by Mr. Priestly. He speaks of the desirability of higher fares being charged for passengers who are carried to race meetings, football matches, and the like. Under the powers that we have in my town we are not permitted to charge any higher fares than those stated in our provisional order; and I take it that that limitation will also be the case in a number of other undertakings. I would therefore like to suggest that in the Bill that is shortly to be prepared dealing with the question of tramway fares generally, whether it would not be possible to ensure that we have authority for meeting such cases as these.

Mr. G. W. Holford (general manager, Salford Corporation Tramways).—I would just like to clear the ground for the last speaker. In the Bill which was recently before Parliament we had a clause asking for special powers to charge special fares for race meetings, football matches, and things of that character, and that Bill has been passed. We now have full powers to charge extra fares, and the only restriction is that in running such cars we must not interfere with the ordinary services and routes. Extra cars must be run for this particular purpose. You see, therefore, that the point is covered.

Mr. E. S. Rayner (general manager, Hull Corporation Tramways).—I should like first of all to thank the authors of these papers for the very sound business tone running through them. Councillor Higham in his paper lays down law with regard to concessions which, if it was generally adhered to, would very considerably lighten the burden of the tramway manager, who is out to make his undertaking a paying and efficient concern. There are one or two things in connection with fares which I think we sometimes overlook. The consideration of fares is not altogether a rule of thumb business, or one of sitting down and saying we will have half a mile for a penny, or a mile for a penny. There are other considerations, and these are both technical and psychological. There is, for instance, the frequency of the service, i.e., the critical point to which you can increase your service and make it pay, neither having too quick a service nor too slow a service. Another point is the size of car. I think a very great deal can be done in hitting off the happy medium between the frequency of your service and the size of car to deal with your loads at various times. I have noticed in several towns, and it is pretty obvious by the returns which we get from the various undertakings, that an effort has been made to put more than the last straw on the existing tramway undertakings. You hear of enormous overcrowding; of a 56-seater car carrying 128. (Laughter, and "No.") Yes, it is quite possible. I have done it myself—(loud laughter)—so I know. The point is that I think as a whole we ought to settle upon some standard of service. Are we going to have the high standard which we were arriving at before the enormous increase in running costs which we have to-day, or are we going to degrade the standard of tramway service to fit the costs of to-day? That, I think, is one point we have to consider. If you are going to skimp your service, if you are going to allow unlimited crowding, if you are going to neglect your rolling stock and neglect your track, then possibly you may be able to run your cars at a smaller percentage above the existing fares than the actual percentage of cost increase should bear to those particular fares. By that I mean to say you have degraded your standard instead of maintaining it and increasing your fares in fair proportion. In my opinion I think the question of the payment of increased fares, or rather the difficulty of obtaining them, is more or less a temporary one. The value of the penny has depreciated very rapidly in the last few years, and the adult public have not got acclimatised to it yet. Children realise this better than we do. Whereas I, as a boy and up to six years ago, used to look upon a penny as having some purchasing power, and if I had a penny I used to realise that I could get, for instance, a stick of chocolate, my boys realise that a penny is no earthly use to them, and if they want to buy that same stick of chocolate they have to pay 2½d. or 3d. for it. They have not the same difficulty as the man of to-day who four or five years ago used to get a tram ride for a penny and to-day is asked to pay 2d., or ought to be asked to pay 2d.—perhaps that is the better way to put it. He does not appreciate the position—old habits die hard—but I think it is only a question of time before he also will appreciate the position. Your postage is 2d., your railway fares are up 100 per cent.; practically everything else is going up, and it is for you gentlemen to educate the man who has got to use the tramway that it is not unreasonable to ask him to pay 2d. for a penny ride, and that brings me to another point—fare stages. We have had to consider fare stages in Hull, and we gave the matter very careful consideration. There were two or three schemes. There was a penny a mile. There was a zone scheme, and there was a scheme for retaining the existing stages and simply adding the additional cost to the existing fares. The alternative was the question of retaining penny stages, and simply saying that the additional cost is 50 per cent., and, keeping the same stages, putting on the extra cost. (Hear, hear.) That has many great advantages for these reasons—it is very simple, and it brings home to the mind of the man in the car that he is paying 1½d. because it costs 1½d. to go the same distance. Whereas if you juggle with your distances and carry him half a mile, and then annoy him by asking for another penny, or charge him 2d. for a distance he does not want to go and a distance he is not used to, you lose his custom and he loses his temper. Suppose, for instance, you shorten your distance for a penny from 1½ miles to one mile, and introduce a penny fare from one mile onwards, you do not get the same proportionate increase in receipts, because in order to save that half mile people will walk the intervening distance, whereas if you charge 1½d. for the old penny fare distance, you do not get this walking of that short distance, and you gain the additional number of passengers. That has been our experience—that by leaving the stages as they are and making the necessary increases to the existing fares, the resultant decrease in the number of passengers is comparatively small as compared with the loss shown in other towns where the distances have been shortened and new conditions introduced. Therefore I should like to say that in my opinion, at any rate, the principle to be adopted is to increase the frequency of your service up to the limit, keep your stages as long as you can, preferably the old penny fare stage, and add your additional costs on to your existing fares. People are used to them, and it shows them what they are paying for. There is just one other item. I think the objection to pay increased fares is largely a psychological one. (Voices, "What, what?") Yes, a psychological one, and I should like to advocate the introduction, if possible, of a new coin which would be a 1½d. coin. I think that if we had a 1½d. coin to meet the 1½d. fare it would make a wonderful difference. A man would pay one coin but objects to pay two for his 1½d. fare. (Some laughter.) I do not think it is amusing, and I am of the opinion that the more you think it over the more you will see there is something in it. There is no objection to a 1½d. coin. The sixpenny piece is half a shilling, the threepenny bit is half of sixpence, and the 1½d. coin would be half of threepence, so that you get a good figure and a very easily worked division.

Mr. J. S. D. Moffet (general manager, Belfast Corporation Tramways).—First of all I should like to accord my hearty support to the statements made by Mr. Priestly and Councillor Higham in their papers on tramway fares. The subject is the most important one before the conference. I think most of us must have had the experience of going through the whole gamut of fare building. I know that since I went to Belfast in October, 1916, I have done very little else, except, of course, dealing with a few labour problems. (Laughter.) I had not been there more than six months before I had to advise my committee that if we wanted to secure the financial stability of the undertaking there was only one way to do it, and that was to tackle the fares question; for when all is said and done fares are the basis of the whole of your financial structure. I was told immediately this was brought up that, if I knew anything about tramway matters at all I ought to be able to put the finances of the undertaking into a proper state without bothering about the fares. (Laughter.) "What about the conductors?" I was asked. "Are they not missing fares?" and I was assured that if they got in all the fares they missed the problem would be settled. I could not convince the critics that missed fares, which tramway managers, as we all know, try to reduce to a minimum, are almost a negligible quantity, but after a lot of abuse and a lot of criticism the Corporation finally decided to move in the matter. At that time we had a mixed system, consisting of a 1d. fare from the centre together with a cross-town 1d. stage, and also what was called a "2d. universal fare"—i.e., for 2d. you could travel from one side of the city to the other, a distance of seven miles on the longest section. The latter was hard to get abolished, although very few passengers travelled over the whole route, and only then perhaps once a fortnight or once a month, or even six months. The first thing to do therefore was to persuade the committee to go in for something that they had not handled before, viz., the graded fare system, which we hear the Americans talking so much about. Mr. Dalrymple, Mr. Fell, Mr. Hamilton, Mr. McElroy, and Mr. Fearnley, like myself and others, received a visit some time ago from Mr. Walter Jackson, of New York, U.S.A., who was on a tour in this country gathering information on graded fares. We subsequently introduced such a scheme—i.e., 1d. fares with overlapping stages forming consequential 1½d. and 2½d. fares. I call it "overlapping" for this reason, that the overlapping 1d. fare starts from the middle of one stage and

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terminates in the middle of the next end-on 1d. stage throughout the section, and this in turn creates intermediate or consequential fares. The result of these changes was that for the year ending March 31, 1918, the receipts increased by £53,700. The new fares were put into force on May 21, 1917, and for the year ending March 31, 1918, the revenue increased from £301,300 to £355,000. In March, 1918, we found that things were going from bad to worse. We certainly had a surplus for that year, but, owing to the increase in the cost of material, labour, and everything else, I had to advise my committee to tackle the fares again and to do away with the overlapping stages and the 1½d. and 2½d. fares previously mentioned. The Council fought that very strongly, and one 1½d. stage was left from the centre of the city, which I may say caused a good deal of dissatisfaction amongst the travelling public. This new revision of fares, however, did very well, and the passenger traffic actually increased instead of decreasing. The reason for this no doubt was that there was more money about, the munition and other workers in the district having benefitted by numerous increases in wages and extra bonuses, with the result that in 1919 the receipts had increased by £51,300, bringing the revenue up to £406,300. For the year ending March 31, 1920, the receipts rose to £545,300, a further increase of £139,000. In July last we were compelled to increase the fares for the third time, but, gentlemen, there is a limit to that, and I think we have just about touched that limit. I say that because at the end of last month we were £3,000 to the bad. Some people may say it is due to labour troubles, the strikes and other troubles in Ireland, but personally I think we have just approached the limit, as we have got down practically to a mile for 1d. If it does not pay at a mile for 1d., then you have to consider some other way, and the only other way I can see is to put it up to 1½d. (Hear, hear.) The problem before us is, how are we to get the extra money that is required to meet our expenditure? By increased service, some may say, but that will cost you more. There is a point at which you will fail to get more revenue, and then you are in a quandary. How are we going to meet that? That is what I want to know. I am fully aware that whilst we talk of 1½d. per mile in Great Britain being high, in America it is 4d. a mile. I do not believe the travelling public in the United Kingdom will pay 4d. per mile. I should like to hear this morning from the various speakers how many undertakings have really gone up to the minimum of 1½d. per mile. I believe a good number of systems have already done so, but so far as I can see it is going to be a very serious position for some of them, very serious indeed. My question therefore is," How can we raise more money? "

Alderman W. Stanbury (vice-chairman, Oldham Corporation Tramways Committee).—The subject under discussion, to my mind, seems in its principles very elementary. You will pardon the observation, but in Oldham we settled the matter long ago without any great discussion. We have a habit in that part of the country of dealing with everything that we have to deal with on sound business lines. (Hear, hear, and laughter.) We came to the conclusion some time ago that there was but one thing to do if we were going to conduct our tramway undertaking on business lines. Therefore we instituted the 1½d. fare in place of the 1d. fare, and we increased all the other fares in proportion. The result has been that instead of a loss we have had a certain amount of profit. We have been able to do all that was necessary in the proper equipment of the undertaking, and we have a system of which we are proud. It seems to me that there is the one logical conclusion to all the remarks that have been made here to-day in the consideration of this question, and that is that we should put our undertakings on a sound business basis by charging an equitable fare for the services that are rendered. (Hear, hear.) Mr. Moffet has mentioned that they were faced with a certain amount of lack of patronage at the institution of the altered fares. I think we were very much, for the moment, in the same position, but I contend that that is a matter that will entirely adjust itself; and if we do the thing in a common sense business manner, as suggested in the papers and by the majority of the speakers, I think we shall have no trouble with this matter in the future.

Mr. J. B. Hamilton (general manager, Leeds City Tramways).—With the counter attractions of the horse show present in my mind during the somewhat lengthy talk from Liverpool, I must say it led me to think that I had better have been somewhere else. I deprecate, and I think we all do, as Mr. Furness said, the introduction of matters which are entirely within their own household, much as we appreciate the position taken by the Liverpool representative. We are here, however, to consider fares, and it would be the merest platitude to say to the gentlemen who have brought this subject forward that they are on very firm and incontestible grounds in stating so fully that fares ought to be sufficient to cover all costs. I thank them very much for bringing this question of fares forward. The whole series of our papers at this conference deal with finance, and I cannot help thinking, with every respect to the chairman and vice-president, who selected the rotation in which the papers should be taken, that we have put the cart before the horse. We ought to have considered all those economies that the other gentlemen will speak about to-day and to-morrow with regard to repairs and maintenance and power costs, and having got their views with regard to these matters, we could have come more prepared to the real pith of the whole matter, viz., the charge to be made to the public for these services. The gentlemen who have given us the papers to-day have been content to rest on agreed bases, and I regret very much that neither of them has considered it necessary to indicate a method of arriving at an adequate fare, or to indicate any principle on which to compute what the fare ought to be. I agree—everyone must, I think—that no general statement can be made which could deal with all conditions and places. These must be dealt with according to their individual circumstances, but it seems to me that we would have begun with a promise of a more useful discussion had we commenced by saying, " Now, then, how can we settle what is an adequate fare for different lengths of ride and under different conditions? " That is the pith of the whole matter, it seems to me. I am an optimist, like the Lord Mayor, and I believe the public will support the tramway undertakings, properly conducted, if we charge no more than adequate fares. (Hear, hear.) What we have got to do is to convince them that these fares are required, and that they are not in excess. In the latter respect, the contemplated legislation of the Ministry of Transport of course very clearly limits the possibilities of predatory chancellors of local exchequers in the various municipalities taking large sums of money from the tramways for general relief of rates. It is said distinctly that if we want increased fares they shall not be used for the purpose of providing sums for the relief of the rates, so that is very well safeguarded. Therefore what we have got to do in our respective towns or places is to endeavour to make a proper calculation of what each fare ought to be adequately to provide the necessary sums for working costs and capital expenses; and if the public have confidence in that, I am perfectly satisfied that the convenience and advantage of being carried, as our tramways have carried millions of people for the past twenty or thirty years, will gradually overcome any scruples with regard to the increased fares. I agree perfectly that fares and increased charges require an educative process. During the last three years there have been continued demands for and grants of higher wages and advances in the costs of the material required. Most undertakings have therefore gradually increased their fares. I think my experience will be the experience of everyone engaged in tramway operation, that whilst immediately a fare is raised you lose a certain number of passengers who form the noble resolve to walk rather than ride at higher fares, gradually that disappears, and they come back again. We have often discussed fares at these meetings during the last three years. It has been a great advantage, but our difficulty has been to know what our costs are going to be. They have been on a rising scale all the time, and therefore that scientific and very careful examination of the fares which ought to be made has not been possible because by the time you have got that carried out and your observations made, you have a fresh demand, and away you go again. Now, gentlemen, are we at the period when we can begin to say, " We have stabilised our wages conditions," or that " as far as we can see we have stabilised the cost of materials that we require? " Is this the time to say we will put in force a fare which will require little if any alteration? I think that alterations in fares are one of the most unsettling things which the tramways industry has to deal with. They disgruntle the public, and lead them to make critical and adverse remarks, often with little knowledge of what the actual conditions are. Therefore those of us who have gone forward cautiously in regard to increasing fares feel that it is a reasonable and proper request to consider whether the present is the right time to say we have arrived at the peak of our costs in order that we may endeavour to bring our charges for the different classes of our passengers into some uniformity. We have talked considerably round about this subject rather than attempted to indicate how we ought to analyse, how to apportion the cost of riding to the individual passenger pro rata to distance travelled. I remember at Wolverhampton many years ago hearing a paper of Mr. Mallins, of Liverpool, who asked, " How far can we carry a passenger for a penny? " Unfortunately I think the conference of managers at that time took the query with a good deal of levity; but after all, gentlemen, it is a serious question, and one you have to settle to-day or some time in the immediate future. If you are going to put your fares on an acceptable basis, as I have indicated, and so secure the confidence of the public, you have got to settle, in accordance with distribution of your passengers and how far they travel and at the different hours, what amount should be charged pro rata to each. You have got to have regard to the enormously increased cost of renewals, which is a somewhat heavy item, and will continue so for a considerable period, in estimating what an adequate fare should be. It seems to me that any person desiring to consider this question

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must give it very careful and lengthy examination as regards how far the passengers travel and at what hours, and in connection with this latter point I think we should not overlook the change which the lessened hours of labouring classes have introduced in tramway travel. Formerly the workman, at whatever time he began in the morning, did not finish until 5.30 or 6 o'clock at night, and that allowed other classes of passengers and shopping people to be carried before the workmen's service began. Now you have got the workmen traffic coincident with the other traffic, and the result is that at 5 p.m. there is an abnormal development of traffic which may continue for 1½ hours. It is finished by 6.30 at latest. During that period, and only during that period, we find it impossible with even a largely increased service immediately to provide accommodation to carry all the people who want to be carried during this short period, and the consequence is they have to wait five to ten minutes. Therefore I suggest, in considering the question of fares and the provision of special services during that 1½ hours, to have regard to the fact that it is impossible—and I say so very confidently—that it is impossible economically to employ car crews and give them an eight hours day or a 48 hour week, when their services are really only required for 1½ hours a day. I do not agree with Mr. Priestly in his statement with regard to overlapping fares. There are conditions which would justify Mr. Priestly in not having overlapping fares, such as thinly populated districts, where there would be a fare for a certain distance, and anything over that distance would be double the fare, but in most populous towns which are represented at this conference I am perfectly satisfied that the density of the traffic is sufficient to justify having at least one overlapping fare on each fare given, i.e., a penny fare stage, if there are such, should have at the centre of it the beginning of another stage. Nothing is more likely to deter passengers joining your cars at all periods of the day than abolishing the overlapping fares, particularly on busy routes. I hope in considering that you will realise the tremendous drawback it is to passengers who live half way between the stages and desire to ride, but have to pay practically double fare in comparison with the others. I believe that the most important part of the business of the conference is that which has been so ably dealt with in these two papers, and they should give each delegate present very serious subject for consideration, because I repeat that if you can satisfy the public that you are only charging the proper and right fare your traffic revenues will become sufficient to meet all costs in the same degree as when fares were on a pre-war basis.

Councillor W. J. Squires (chairman, Highways Committee, London County Council).—I did not intend to trespass on your time and it will only be for a few minutes. I do not care, however, to give a silent view on such a matter as this, and may I say at first that I agree almost entirely with the two papers which have been read. To me, the question of the increase of fares is an item which every business man has carefully to consider. I have always been, and I think always shall be, totally against any undertaking such as tramways contributing to the rates or any other source. That is not business, in my opinion. I believe that we have a commodity to offer to the travelling public. Very well, that commodity must be treated as all other matters, and you are bound, gentlemen, if you are going to do your duty as tramway men, to give the best to the public for what they pay. The public have no right to expect more than that, and if you charge according to what your costs are at the present time, in order to obtain from the public the revenue which you must have to pay your way, I do not believe that any man or woman will object. Has it ever occurred to the members of the Conference what has been the extra cost that has been placed upon undertakings? I can only mention that which I happen to know something about. May I tell you, gentlemen, that an extra 1s. per week per man for a full year on the London County Council Tramways means a charge to that undertaking of no less a sum than £30,000 a year. We have had to meet an award of 9s. per week, and if you multiply 30,000 by 9s. you get at once a charge of £270,000 placed upon us, almost in one week, so to speak. What I do say is that these are matters that we have to make clear to the public. A great many people are ignorant of what is the cause of our necessity to raise fares. Since I have been in Cardiff, I have heard already about the London County Council and its cheap mid-day fare. Well, gentlemen, in the presence of my general manager I do not deny that I have always been entirely against it—(hear, hear)—and what I have said in the Council chamber I am not afraid to say here or anywhere else. I do not believe that the travelling public of to-day are going to appreciate that sort of thing as some people think they do. We had a special meeting to consider that very point and I had to bow to the inevitable; I was beaten by one vote. I am still of the same opinion, however, that it is not necessary. I do not think it is a right step, when you know well that in order to carry on as you should, the question is one of raising fares and not lowering them. I do not wish to detain the conference but I wanted to express my own humble opinion as a member of a body which has a very great diversity of opinion—I can assure you of that; at the present day I do not think that any Council in the country has more of that than the London County Council. I want to say this, that I am totally in favour of the adjustment of fares which shall meet the entire charges and costs of the undertakings. Give to the public the best you possibly can for what you charge them and I do not believe, as I said before, that the travelling public are going to object. Why should they? They are quite agreeable to pay for other things. It has been said by one speaker that even your postages are up 100 per cent. more than they were. Is anybody going to send fewer letters than they did? In my opinion, if it was necessary for the Government to take that step to get revenue, then I say in the case of travel by tramways the public must pay for what they have, and that payment must be sufficient to meet all the costs that are thrown upon the undertaking.

The President.—This is a very interesting subject and there are others who would like to speak upon it. It is now nearly lunch time, and it seems that we shall have to continue the discussion this afternoon. I propose that at one o'clock we adjourn the discussion until after luncheon. We will hear Councillor Turner now and then adjourn.

Councillor Turner (chairman, Belfast Tramways Committee).—I believe I am right in saying that there are just two of us from Ireland. (Laughter.) You have heard Mr. Moffet and now I wish to say a word or two, and I assure you that we are perfectly harmless. I should like to congratulate the two gentlemen who have read these papers because they are, in my opinion, very important. They are the most important that could be placed before a conference in connection with tramways. The first was read by a layman, like myself, and there is a good deal of common sense running through it. The second was read by a practical manager, and there you have the technical point of view. But there is one thing which struck me in reference to this discussion, beginning with your address, Mr. President, in the Council chamber, and that is in reference to workmen's fares. You, Mr. President, did not mention workmen's fares but you said that a passenger must pay for his passage. I think that would include the workman. Councillor Higham states, "I am firmly of opinion that there should be no subsidised fares," and Mr. Priestly says in his paper, "The fares charged ought to be laid out on an equitable basis, i.e., each passenger should pay his share of the sum of the different items of expenditure." The greatest difficulty which tramway undertakings have, I think, is in reference to workmen's fares, and it has very truly been stated by Mr. Priestly that the undertakings are called on, as in the case of our own, to supply special cars at a special hour, which is known as the peak hour or the rush hour. That is the time when you can least afford them. But you have got to supply special cars to carry passengers at an uneconomical rate. That, in my opinion, is a thing the Conference should take up in connection with arriving at a policy concerning fares generally, which are, of course, the main source of revenue. There is little else except advertisements or something of that kind. Every city and town is a law unto itself. Glasgow, for instance, have no charges in the way of sinking fund and the like, whereas we have a capital of something like £1,500,000 and we have to meet the sinking fund charges on that. Therefore, I say that every city and town is a law unto itself, and it is the common sense thing for every town and city to fix charges so that they will meet the expenditure. That is common sense, and that, I think, would meet the case generally. It is only a question of what is the best method of fixing your charges to obtain enough revenue to meet your expenditure. There is, of course, the gentleman from Walthamstow—who said he is a Scotsman—who was talking about the charge of 1½d. this morning, but if he had looked at his programme he would have seen that the Corporation Committee has very kindly consented to carry the members of the Association free of charge. (Laughter.) But he suggests that the time may come when tramways would be wholly put upon the rates. How he arrives at that I cannot see. I really cannot see any logic in that whatever. (Hear, hear.) However, as I have said, every city and every town is a law unto itself. I should like to congratulate the two gentlemen who have read these excellent papers.

The President.—I should like to make the announcement that we have some visitors with us to-day, and I am sure it will be your desire that I should refer to them and offer them a special welcome to our conference. We have Mr. Tegetmeier, chairman of the Tramways and Light Railways Association. You all know that Association, and Mr. Tegetmeier has recently been appointed to the chairmanship. We have also one of our honorary members, Mr. John Young, whom you will remember as being really the founder of our Association. He was certainly the first president, and I remember very well the year of his office, and many of us who are here now will recall what an auspicious opening for the Association it was. Then we have Mr. Spencer, late of Bradford and now occupying another position. There is also another gentleman whom I must mention, and that is a gentleman from America,

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Mr. Todd, of Kalamazoo, president of the Public Ownership League of America. I know he will be specially interested in this conference. We met Mr. Todd recently in London, and he was very desirous of coming to Cardiff, and I am sure you will be pleased to see him here. To all these gentlemen we offer a very hearty welcome to Cardiff, and I hope they will have a good time. (Applause.)

The conference then adjourned to luncheon in the City Hall at the invitation of the Chairman and members of the Cardiff Tramways Committee.

AFTERNOON SESSION.

The discussion on the two papers by Councillor Higham and Mr. Priestly was resumed in the afternoon.

Mr. H. Mozley (general manager, Burnley Corporation Tramways).—There are just one or two points which I should like to bring to your notice. First, there is an omission of any reference in the papers to sources of income other than fares. That may seem a contradiction, but this is what I mean; there is no reference in the papers to any system of seeing that you get all your fares. One of the most serious losses we can sustain in tramway undertakings is the loss of fares missed by conductors, and I want to remind you that there is a method of preventing the missing of fares which, strange to say, is confined almost to my own system—(hear, hear and laughter)—and that is the collection of tickets by the conductor. The missed fares on British tramways are certainly not less than £500,000 per annum—(A voice: Question)—and if a simple system can be put into operation which prevents that loss, I think I should be very remiss in my duty to you if I did not tell you of it. It is a fact that for a number of years I have called your attention to this difference between our practice and the practice of other tramways without any result. I have appealed to the managers without any effect, except in one or two instances, but at this meeting we are favoured with the presence of the members of the Councils, and I invite them to give their attention to the subject. (Hear, hear.) It seems quite useless appealing to the managers. (Laughter and hear, hear.) I am not doing this to amuse you at all; I am quite serious. Someone just said "question" when I mentioned the amount lost through missed fares, but there are 10,000 cars in operation daily, and the amount which has been estimated as lost from missed fares per car is £50 per car per annum, so that you can complete the figures for yourselves; it is really a very serious matter indeed. It is a fact that, if you do not collect the tickets, if the tickets are not collected by the conductor, and the conductor only, this loss must continue, and I want to assure you that the system is easy to carry on, that the conductors themselves appreciate it directly they have had an opportunity of putting it into operation, and the public themselves especially appreciate it, whilst you will find a very important appreciation of your income if you will adopt this system. Therefore, I appeal to you to give this matter your serious and earnest attention, because I believe that I am quite right in what I say. I have had 40 years' experience of it. Of course, our people have never known anything else, and it is very strange, at all events, it is a mystery to us in Burnley, why it is so difficult for other people to understand it.

Alderman Smith (Liverpool).—When do you collect the tickets?

Mr. Mozley.—Every conductor, when he approaches the end of the line, within a quarter of a mile of the terminus, goes round to every passenger and requests him to produce his ticket, and he collects it. I know that is very elementary, but if you do not do that you cannot be sure that you have got the fare of that passenger. There is no other method of ascertaining whether the passenger has paid or not.

Alderman Smith.—What about the intermediate stages?

Mr. Mozley.—In the intermediate stages we require the conductor to be on the rear platform, and when the car stops to pick up or set down he collects the tickets. No driver on our system will start a car without a signal from the rear platform. The conductor, therefore, collects the ticket from the passenger as he leaves the car en route. Shortly, that is the system, and within a quarter of a mile of the terminus he goes round to every passenger on the car and makes him prove that he has paid his fare. There is no other method. I challenge you on the point. There is no other method of being sure that you get the fare from the whole of your passengers. If I have not made that quite clear to you I will answer any questions on the point. This is really a very serious matter for you, because you are losing money at a very great rate, and in addition you are encouraging disorder on your cars. There is nothing so strange to us as to go into other towns and see the disorder on the cars and the disorder in the streets by the tickets being thrown about. The conductor on our system goes round and collects these tickets, and must deposit them in a box on the rear platform, a specially-constructed box. That method is open to everyone. It used to be objected that the possession of an old ticket by a conductor was a source of danger, but I want to remind you that, by the system of non-collection of old tickets, old tickets are just as available to the conductor as they are when he goes round and collects them systematically, so that I think that is no real objection, and I venture to ask you seriously to go into this matter, because I should like to see the reform carried out. I have talked about it until I am rather tired of it myself. I do not mind at all your saying the things that you do, because I know that I am right and my people know that I am right, and the Burnley people, who have been educated from children in it, know that I am right; and what they cannot understand is why you do not take advantage of the same system. The other matter I want to mention is the question of workmen's fares, but, before I leave the other matter, may I just say that, a few years ago, by the courtesy of the Editor of THE TRAMWAY AND RAILWAY WORLD, I was able to lay before you the version of three of our senior conductors, in their own language, on the question of the collection of tickets, and if you will refer to THE TRAMWAY AND RAILWAY WORLD you will there get the conductors' version of the matter in their own language and, therefore, you need not think it is a Mozley fad or anything of that kind. It is nothing of the sort, but I say seriously that you ought to go into this matter. It will be to your benefit if you will do so. With regard to the workmen's fares, I differ *in toto* from the attitude of Alderman Higham and others on the question of workmen's fares. Of course, it is illogical to say that you should carry one passenger at one rate and another at another, but logic, of course, is not everything. First, it is the public policy of Parliament to grant workpeople going to and from their work a reduction in their fares of 50 per cent., is it not? And recently that has been confirmed, and no Council in this country, so far as I am aware, has ever ventured to suggest that they should abolish workmen's fares.

Alderman Smith (Liverpool).—Liverpool has none.

Mr. Mozley.—I am going to touch on that. It was not until recent times that the great cities, who found their systems going gradually towards bankruptcy, began to wake up to the fact that they had been carrying their ordinary passengers at workmen's fares, and it was only when they came to have a differential class, by law they are compelled to give workmen's fares, that they found how difficult it is to do anything of the kind. They have to differentiate between the workman and the ordinary passenger and, therefore, they said "Away with workmen's fares, they are uneconomical." (Hear, hear.). I want to point out that the workmen's traffic must necessarily be the most profitable traffic we can carry. (Cries of "No, no" and "Yes.") I do not mind you saying "No"; I am here to state facts as I know them. You are just as much at liberty to contradict me as to agree, but what you have given me permission to do is to give my views and not yours. I want to point out that on all workmen's traffic you always have a full carload. (A voice: One way.) The capacity of a car will, of course, vary in different towns, according to their advancement in tramway science, but in our case our cars will seat 73 people, and during the hours of workmen's traffic these cars are packed to suffocation. The result is, of course, that the earning capacity of that car is fully four times the earning capacity of an ordinary car, and I want to remind you that, if a workman is habituated to use the cars to go to and from his work, he is not going to walk to his pleasure; and further, you must remember that 90 per cent. of our traffic consists of working people, or, at least, people in receipt of a weekly wage. Therefore, if you give the workman encouragement to use the cars to and from his work, it is only a slight encouragement for the traffic he produces for you by his family and by his ordinary pleasure. Therefore, I say, to propose to abolish workmen's fares is against public policy, and it is against the policy of any Corporation that I am aware of; and I think the proposal is altogether premature and you must endeavour to deal with the traffic in another way. You will probably object to my telling you how we deal with it, but I want to assure you that, although our workmen's tickets are available up to 8.30 in the morning, for 1½ hours at the dinner time and for two hours in the evening, we differentiate successfully between the working man and the ordinary passenger.

Alderman New (Sunderland).—I just want to say that, as regards the writers of the papers, I think they have done invariably well, because the discussion has been thrashed out many times before, and although different municipalities may have different ways of handling this question, this conference may well agree as to the general principle that no one can be carried for less than ordinary rates. I have heard no argument yet that workmen should be carried as workmen any cheaper than any other worker. In other words, if a man happens to travel with his wife he has to pay the ordinary fare for her, whereas he himself pays workman's fare, and yet he pays for his wife out of his workman's wages. With regard to the question of whether it is possible to continue penny fares, I say with all deference that, although in many concerns it may be possible to continue for some time the charge of one penny a mile, I do not think it is possible in all concerns. It may be possible for a considerable time to charge a penny a mile if you only carry a passenger one mile, but after that distance you must increase the fare. The question of transfer fares depends entirely on the amount of your initial charge. In Sunderland we have always resisted the possi-

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bility of having a halfpenny fare, but, in order to resist that successfully, I think it was absolutely necessary to establish the transfer system. The transfer system no manager is in love with. I do not think any manager that I have discussed the matter with is in love with the transfer system, but it is a boon to be able to make cross-country rides where there is no direct service, and we find that the transfer system is the one thing which can give us that. But as soon as we increased the fares to a penny a mile, the transfer system was done away with. With regard to Mr. Mozley's point concerning the collection of tickets, I cannot imagine that being possible when a car is carrying, as Mr. Rayner mentioned, 128 passengers. How can a conductor collect the tickets in those circumstances? What happens at the intermediate stage? In our service we make it a rule that the man who is collecting the fares shall take the lower deck first, in order that, when he comes to the upper deck, nobody may leave the lower deck who has not paid. I do not think the collection of tickets does away with the possibility of a passenger leaving the car without paying his fare. We find that very often the public act in the public interest by telling the conductor when he has not collected a fare. However, I do not want Mr. Mozley to convert other tramway managers to his view, because you will have to have two conductors on the car.

Mr. H. P. Stokes (general manager, Plymouth Corporation Tramways).—There is one point in connection with this discussion which does not appear to have been touched upon. We are dealing primarily with the question of tramway fares, and it seems to me that in considering this matter, we want to bear in mind the somewhat changed aspect which has come over the work of every tramway undertaking throughout the country as the result of the increased earning capacity of workers. I think it is admitted that, throughout the war, tramways have had a very considerable increase in passengers carried, due to increased earning capacity, and, therefore, the increased cost of operation has, to a certain extent, been met by that increase in traffic due to this greater earning capacity, principally of the working classes, who are our greatest source of profit. At Plymouth—here I must disagree entirely with my friend, Mr. Mozley—we have no workmen's fares. We have no preferential fares of any description for children or anybody. There is one common fare which has to be paid by every individual who travels on the car, and we also have 1½d. as a minimum. We found, when that was introduced, we had a slight slump in traffic, but now it has been going on for some four months we have reckoned our average number of passengers a day shows a tendency to increase. (Hear, hear.) The policy I have acted on in this question of fares is not one of deciding upon any definite amount per car-mile, but rather of taking the local circumstances of the town into consideration, and we have anomalies of this sort actually occurring on the undertaking. In some districts, where the traffic is peculiar in character, we give as much as 3¾ miles for 1½d., and on other routes we give 1¾ miles for 1½d. The average distance which we give over the whole undertaking is 2·72 miles for 1½d. There was one point in connection with Mr. Priestly's paper which I am not in agreement with, although the general policy of both papers is exceptionally sound. I think Mr. Priestly says on the first page that an undertaking "should accumulate sufficient funds for the renewal of the undertaking, as well as its improvement and extension." That is rather a peculiar policy to go on; the question of providing funds for extensions is one I think that very few municipalities would support. Municipalities, generally speaking, are out to give the greatest possible value they can, and to maintain their undertakings in the best possible condition, but if it comes to a question of putting by money for extensions, that is a somewhat adroit way of making profits, and is a policy which, personally, I think would be likely to be a somewhat dangerous one. I thought that our experience with regard to the 1½d. minimum and the fact that we have no differential fares of any description might be of interest to you.

Mr. J. M. McElroy (general manager, Manchester Corporation Tramways).—I want to emphasise as strongly as I can the good advice given us this morning by our friend Mr. Hamilton. He said, and I thoroughly agree with him, that we must find out what the exact cost is in each undertaking. Let us see in that cost that we have got all the items that should go into the cost, including the cost of renewing the various parts of the assets that are wearing out. Having ascertained the full cost, then we should find out what should be the revenue to meet that cost. The public should be told exactly what the cost is. The public are willing to pay, in my view, if they are shown that the cost of giving rides has gone up, but the public want educating to that. I believe that, if a town is giving a good service and shows the public that the cost has gone up by a certain figure, the public will be willing to pay. The question then comes as to what scale of fares should be charged to get the necessary revenue to meet that cost. The first point to be decided is one of policy. It may be the policy of a Council to say that they will charge for the first mile a higher fare than for the average. That policy might be dictated by the view put forward by certain members, that in order to give a long, cheap ride, to spread the population, it is desirable to charge a high initial fare for the short riders. That is not a question for the manager. It is a question of policy of the committees. The policy having been decided, then the manager of any undertaking, if he is worth his salt, should be able to tell his committee, and show it scientifically, exactly what fares should be charged. That scale of fares should provide that every rider pay for his ride, as Mr. Higham has said. I think the whole question—having settled the policy—is one for the manager to advise his committee upon.

Mr. J. Barnard (general manager, Bolton Corporation Tramsays).—I should like to endorse what Mr. McElroy has said, that we should ascertain the cost of carrying passengers, and that the question of the fares thus becomes a matter for local consideration. If you will take our own case at Bolton, I believe you will find that we are the only town in the United Kingdom that has neither changed its pre-war fares nor lengthened nor shortened the distances, and we cannot be accused of not running our undertaking in aid of the rates. Last year we contributed £15,500 to the relief of rates, and paid 2½d. per car-mile for depreciation, and now our receipts are increasing to such an extent that we hope there will be no change in our fares for the year ending March 31, 1921. I admit that we are in a very fortunate position, because in the last year before the war we carried 32,000,000 passengers, whereas for the year to March 31, 1920, with the same rolling stock, we carried 52,000,000 passengers, an increase of 20,000,000 in about five years. It would be a fallacy for our committee to say that we ought to raise our fares when, at the present time, we are meeting all our obligations in interest, sinking fund, and depreciation, and have a balance to go to the aid of the rates. Therefore by what argument could we say that we are entitled to charge passengers a higher fare? It is a question of cost, and when you have ascertained the cost, then you should charge an adequate fare that will just meet that cost. My main point in getting up though is to answer Mr. Mozley, who, for years back, in fact every year that the municipal conference and the managers have met, has always been drilling into us that there is only one system in the world that is correct, and that is the Burnley system; but in my numerous visits to Burnley I have never had my ticket collected, and, further, on most occasions I have never been asked for it. (Laughter.) As I have told Mr. Mozley many times, it is a long time since I conducted a tramcar, but if he would give me a few days' practice and put me on a 3d. route, with over-lapping stages and three 1d. stages, I will conduct his car for nothing. (Loud laughter.) I assure you that I know certain people who would pay him a bonus for conducting a car on such a route. (Renewed laughter.) It is all very well when he is talking to managers, because we do not take him seriously, but when we do get members of the Councils present with us, it probably leaves an impression in some of their minds that everything is not *au fait*, and that tricks are going on at the back of the tramcar. I used to think I knew every trick for making ends meet on the back of a tramcar—(laughter)—but when this unfortunate war broke out, and we had to revert to female labour, I found that some of the females taught me that I knew nothing. (Loud laughter.) The only thing I do want Mr. Mozley to take seriously into consideration is that we, as tramway managers, are out to get the whole of the revenues that we ought to get from our passengers. (Hear, hear.) It is not for us to say that we do not get it, because if we were speaking privately we might have our own opinions about it.

Councillor Higham, replying to the discussion, said—I think it would be the height of absurdity were I to attempt to reply at length to what has been said in this discussion. There is one point, I believe, in which my paper has failed, and failed ignominiously, and that is in raising opposition. Practically the whole of the arguments have been in favour of the points that I have laid down. As far as the opposition is concerned, I sum it up under three headings. There is the opposition of Alderman Smith, of Liverpool—(A Voice, "He doesn't count")—which we have heard very often on that particular point, and it was replied to very effectively, in my opinion, by his own colleague from Liverpool this morning. So I am going to occupy no time on that, except to point out that this system of relief to the rates is a very pernicious one, in my opinion, for the simple reason that once you begin to feed the rates they develop such a tremendous hunger that it is never satisfied, and with our system of local government in this country—which, however much we may try to disguise it, is a system, after all, of government along the lines of party politics—every dominant party is always aiming at keeping down the rates, and if once they get their hands, or their maws, whichever you like to call them, on the tramway undertaking profits, they are not satisfied in taking what I call legitimate profits, but they develop such a hunger as to collar not only legitimate profits but also the reserves of money that ought to go to the upkeep of the tramway undertaking itself. If you give £60,000 or £100,000 to the rates one year, there is no man who is

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responsible for keeping down the rates—I am referring to the leader of the dominant party—there is no man in that responsible position who is ever satisfied to get less than that again. In fact, it has become a rule in some places that a levy has to be put on a tramway undertaking for a certain sum per year, whether it makes it or not. I am satisfied of this, that the first legitimate rule is to give a ride commensurate with the cost of that ride, and charged for accordingly.

With regard to Mr. Murray, I am very glad that he comes from a small undertaking, as I represent a small undertaking myself, and I am convinced as far as small undertakings are concerned—and I would remind you of what I say in my paper—that whilst certain undertakings in our large cities may be able to retain the penny fare—places like Bolton, which has been put forward by Mr. Barnard, may be able to retain the penny fare. But when you talk of retaining the penny fare and reducing distances to get sufficient revenue to meet the cost of the undertaking, you reduce the position to an absurdity, because we all know this, that you have always a certain number of people who will walk up to a quarter of a mile further than the stage rather than pay an additional halfpenny. If you go on the system of keeping up your penny fares and reducing the distance from a mile to half a mile, you will find that your passengers who want to go a little over three-quarters of a mile will jib at paying twopence for the few yards over the three-quarters, and I am convinced that, for the majority of undertakings, the only logical conclusion is to recognise the depreciation of the penny, and that it is not an economic fare if you are going to keep these undertakings off the rates.

There has not been a great deal said in the discussion with regard to the abolition of workmen's fares. It is true that Mr. Mozley points out that workmen's cars are the most profitable cars that they have got in Burnley. Well, if that is so, it seems to me that the logical thing to do in Burnley is to make them all workmen's cars. (Laughter and hear, hear.) He goes further to qualify that by saying that his workmen's cars are running up to 8.30 in the morning, during the dinner-time and at night, when people are coming home from work. I mean that workmen's tickets are available during those hours. I am not going to deal with the question of differentiation by the conductor between one passenger and another as to who is a workman, for, candidly, I confess I believe it is a responsibility which no authority ought to put on the shoulders of any man, but this is the point; Burnley, like Blackburn, is a manufacturing town; our possible customers are locked up in the mills and workshops during the whole of the day. The only passengers that make the cars pay are those who take the workmen's tickets. If that is the case, there is no wonder that the workmen's cars are packed during the hours that Mr. Mozley refers to, and I submit to him that, if workmen's fares were abolished and economic fares substituted during the hours that people have to go to and from their work, there would be a considerable increase in the revenue of the tramway undertaking even in Burnley and every other industrial town. (Hear, hear.) It is all very well to say that the workmen should have cheap fares during the dinner hour, but what occurs to the trams during the hours from nine to twelve in the morning and two to five in the afternoon? You are running them in nine industrial centres out of ten at the present time at an immediate and actual loss on the running expenses, never mind the standing charges, and if you are going to induce the public to pack your cars at a fare which is not economic during the time when you should be able to produce money to make the cars pay their way, then in my opinion it is a very foolish policy. I think the question has been discussed very thoroughly, and I, at any rate, am more firmly convinced than when I began this morning that, as far as the great majority of places are concerned, the penny fare is not an economic fare at the present time.

Mr. Priestly, also replying to the discussion, said—I am not going to occupy very much time, for, as Councillor Higham has said, this matter has been well discussed. With regard to the paper, you have heard what Alderman Smith said, that he will deal with my paper afterwards—(laughter)—so that you see what you have let me in for. I think that the pith of the whole paper is what was said by Mr. Hamilton and endorsed by Mr. McElroy, i.e., what should be charged. There is one point I should like to mention with regard to Mr. Hamilton. He said that in these papers we had not given any guide as to what is a reasonable fare. I think you will agree that it is a very difficult thing for us to do. It must be dealt with upon each individual tramway system. (Hear, hear.) It is not for me or anybody else to say to Mr. Hamilton, "you should charge your passengers so much per mile."

The point raised by Mr. Rayner I do not think enters into the matter with regard to fares so much; it dealt more with the standardisation of cars and overcrowding. That is not the question dealt with by the papers.

With regard to Mr. Mozley, he will not convince me that the workman's fare pays, and with regard to his ticket collection system, Mr. Barnard has dealt with that much better than I could, but does Mr. Mozley check the tickets that are collected against the waybills?

Mr. Mozley.—No.

Mr. Priestly.—If not, the whole system fails. (Laughter.)

The President.—I am sure you will wish me to move a very hearty vote of thanks to Councillor Higham and Mr. Priestly for their able papers and the useful discussion upon them. I think we are very much indebted to them for having given us their views as they have done. Some will go away unconvinced, perhaps, but after all they have made some points with which most of us are in agreement, and I move a very hearty vote of thanks to them.

The vote of thanks was carried with acclamation.

The President.—Before calling on Mr. Fell to read his paper, I should like to say, and I think you will all agree with me, that we are missing one of our old colleagues to-day, that is, Mr. Baker, of Birmingham, whom we are all very sorry to know has been unwell. We have therefore arranged that this telegram should be sent to Mr. Baker—

"The members present at the 19th annual conference at Cardiff send their greetings, and rejoice to learn of the improvement in your health, and hope you will soon be able to resume your place in the counsels of the Association."

The sending of the telegram was agreed to unanimously.

The General Secretary.—At the opening of the conference I ought to have said that Sir Eric Geddes was invited to attend the conference, but he sends his compliments and regrets that appointments in London deprive him of the pleasure of doing so. Mr. Dalrymple also will be unable to come, because, as you know, they are having trouble in Glasgow on the question of a strike, and he has asked me to read his paper to-morrow. Alderman Wylie also sends his compliments, and regrets that he is not able to be here to support Sir John Courtis.

OPERATING COSTS: POWER EXPENSES.

By A. L. C. FELL, C.B.E.
(*General Manager, London County Council Tramways*).

Power Expenses.

At the annual conference of our Association this year the question of finance is to be dealt with from various points of view, and short papers are to be submitted dealing with revenue and expenditure, so that the whole position may be reviewed. The subject allotted to me comes under the heading of "Power Expenses."

Under present conditions this is one of the most important heads of expenditure in our tramway accounts, as by combined scientific and commercial investigation it should be possible to effect large economies. In this paper I do not intend to deal with the matter from the scientific point of view, but will endeavour to touch the fringe of the commercial side of the situation.

Fuel.

The principal item of working expenditure, in order of magnitude, connected with the generation of electrical eneregy is fuel, and as this now represents from 75 to 80 per cent. of the cost of producing electrical energy at the power-station, it is well worth while to devote some time to investigation, to see what is being or can be done to effect economies.

Poor Quality of Coal Sent Long Distances.—Before the war it was possible to issue a fairly close specification for coal, and payment was made for value received. Since 1914, however, anything available has had to be taken, and as far as London and other places in the south-east and southern area have been concerned, absolute rubbish has been supplied in innumerable instances, notwithstanding all the complaints made to the authorities concerned.

During the war tramway services had to be cut down to reduce coal consumption; apart from diminished output of coal, the shortage of shipping and difficulties of transport were well known, and tramway authorities loyally endeavoured to meet the situation, but their efforts to effect economies were, to a large extent, rendered nugatory, as ships were sent long distances from the North and East Coast to London with dark-coloured material, consigned as coal, but in character more like the refuse from a slate quarry, containing in many cases over 30 per cent. of ash, which subsequently had to be barged out to sea and dumped.

To-day the situation is still unsatisfactory. As an indication of the state of affairs, the following particulars with regard to the coal supply to the London County Council's Greenwich power-station during the year ended March 31, 1914, compared with

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similar particulars for the year ended March 31, 1920, may be of interest—

	1913-14.		1919-20.
Tons of fuel burnt	166,040	...	176,400
Total cost of fuel burnt ...	£139,577	...	£348,395
Average price paid per ton for coal	16/9¾	...	41/11·3d.
Average calorific value British thermal units	13,350	...	10,780
Average percentage of ash ...	6·79	...	14·59

It will be seen that the fuel supplied in 1919-20 contained 7·8 per cent. more ash than that supplied during 1913-14, or a total increase in the waste material supplied to the station of 13,759 tons. This waste material, paid for at 41/11·3d. per ton, represents a dead loss of £28,854 during the year. In addition, the extra cost of barging away the ashes at 3s. 8d. per cubic yard amounted to £6,306, and owing to the increasing cost of labour this figure will become more serious as time goes on. The present cost of barging amounts to 4s. 9d. per cubic yard, or a total cost of barging the above quantity of ash would amount to approximately £8,170. In addition to this it has been necessary to incur very heavy expenditure at the station for labour in connection with the removal of ashes

Mr. A. L. C. Fell.

[NOTE.—The figures quoted would have been considerably higher, as a larger amount of fuel would have been consumed in 1919-20 if it had not been possible to bring into commission more economical generating plant.]

Some action has already been taken to utilise low grade fuels locally, and the gas produced when making coke in some of the colliery districts has been used for generating electricity, but the whole arrangements with regard to grading coal should be co-ordinated by the suppliers and transport agencies, so that the lowest grade coal may be utilised where the least transport is necessary, and the quality should improve as the distance from the source becomes greater. Probably in the future, when large bulk supply stations situated in close proximity to the coalfields are in operation, many of the difficulties at present experienced will disappear, but we are passing through a very critical period at the present time, and it appears that by the exercise of a little common sense on the part of the suppliers and distributors considerable economies might be effected at once. The Government should be pressed to take action.

Oil Fuel.—The introduction of oil fuel in electricity generating stations, which are not situated in suitable positions to obtain coal gas at the collieries, would offer great advantages. One of the principal items of expenditure in connection with fuel is transport, and oil could be delivered in bulk under advantageous conditions at a minimum cost for labour. In this form fuel could be made available containing a very small percentage of waste material.

Many years ago experiments were made with oil fuel in generating stations, but the results were not very satisfactory, as only a limited quantity of low grade fuel was available. Since that time the whole position has altered, and there is no reason why the possibilities of oil-burning should not be taken into consideration. This is a matter which should receive the careful consideration of the Electricity Commissioners.

Coke.—The following is a brief *resume* of the action which has been taken at the Greenwich power-station since 1917—

In the autumn of 1917, under-feed grates were fitted to four boilers at the Greenwich power-station, with a view to burning coke for steam raising. At first the results were not very successful, but after many experiments had been carried out a type of arch was found, with which satisfactory results were obtained, and, at the price of coke at that date, considerable saving was effected by burning coke on these grates.

Early in 1918 experiments were also carried out at Greenwich with a view to burning coke on the "sandwich system" on the Stirling boilers, i.e., a layer of coke was laid on the grate with a layer of coal above it. These experiments proved successful, and when the Coal Controller decided to curtail coal supplies by 15 per cent., it was found possible to make up the deficiency by using coke in this manner. The results obtained were so satisfactory that the Coal Controller recognised them as being of public service, and arranged for engineers from other undertakings to inspect the lay-out, with a view to adopting a similar system.

Since that date, however, the price of coke has risen considerably, and from a financial standpoint there is very little advantage in using coke at the present time. Moreover, it is necessary to instal special coke cutting or crushing apparatus, and generally to alter the shoots for the supply of this fuel.

In connection with the utilisation of coke, the question of storage is an important one, as broken coke occupies about 75 cubic feet, and coke breeze occupies about 60 cubic feet, as approximately against 45 cubic feet per ton of coal, as coke has a calorific value of about 11,500 B.T.U. per lb., with 10 per cent. of ash, whilst coke breeze has a corresponding value of about 9,000 B.T.U., with 18 to 20 per cent. of ash.

During the year ended March 31, 1920, about 25,000 tons of coke and coke breeze were burnt at Greenwich, this quantity representing about 14 per cent. of the total fuel.

As an example of the results obtained, it was found that with Scotch nuts at 42s. per ton, and coke breeze at 22s. 6d. per ton, the cost per thousand pounds of steam is approximately 19s. 6d., with approximately equal quantities of each fuel, as against 23s. 2d. with nuts alone.

It should be noted that the coke was supplied from a gas works which are situated only a short distance from the station.

NECESSITY FOR A CHEMIST IN A GENERATING STATION.

Engineers have done, and are doing, their best to increase the efficiency of the plant utilised in connection with the production of electrical energy. It has for some time been realised that it is essential to have a skilled boiler-house engineer, who can devote his whole time to fuel combustion problems, but it should also be recognised that to get the best results it is necessary to have the assistance of a fully qualified chemist at the station. At Greenwich this has been found a most economical arrangement; the chemist appointed is lent to the tramways department, and works under the direction of the Council's chief chemist, who himself is called into consultation as necessity arises. The duties performed by the chemist, in so far as the boiler-house is concerned, are as follows—

1. Tests of fuel to determine calorific value, moisture, etc., both on supplies received and on representative samples taken from the bunkers.
2. Test of furnace ash, to ascertain whether all the combustible matter has been fully utilised.
3. Tests of flue gases, to determine whether the fuel is being burnt to the best advantage.
4. Tests of boiler feed water and condensate, to ascertain whether impurities likely to affect the boilers and plant in an adverse manner are present.
5. Tests on boiler water, to determine the concentration of salts and the necessity for blowing down.
6. Tests on water before and after softening, and on the lime used for this purpose.

In addition, tests are carried out on deposits from leaking steam pipe joints and in all cases of boiler corrosion.

In cases where the generating station is not large enough to justify the appointment of special officers for the purpose, arrangements might be made by the municipality for this work to be done in conjunction with other chemical investigations.

FURTHER POSSIBILITIES OF ECONOMY.

So far only matters relating to the production of power have been dealt with, and although all these have an important bearing on the reduction on the cost of production, we must see what can

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be done with regard to economic consumption of electrical energy. Whether we produce or purchase the necessity is the same. In one short paper it is impossible to deal in detail with all the items where economy in the consumption of power could be effected, but special attention might be called to the following—

Bonus Scheme for Reduction in Power Consumption.—The London County Council approved a scheme granting 50 per cent. of the value of the direct saving in fuel due to decreased consumption of electrical energy effected by motormen and conductors in the operation of the Council's tramways. Particulars will be furnished to any members on application. The scheme has not been so successful as was anticipated, but it is formulated on right principles. The influx of new men since its introduction has militated against its success, but it is still believed that, with the co-operation of the men, it is possible to make a scheme of this description a success.

The Use of Trailer Cars.—To deal adequately with this subject, a separate paper would be required, but here it is only necessary to state that on a system such as that which has to be dealt with in London, where there is an enormous peak load for a brief period in the morning and again in the evening, trailer cars have proved to be very economical, especially from a power-saving point of view, and a recommendation is now being put forward to the Ministry of Transport for an extended user of trailer cars on the London County Council system.

Statistics obtained from metered readings, etc., on cars in regular service in London, with and without trailers respectively, averaged over a period of 45 weeks, gave the following results—

Tractor and trailer	...	...	2·87 units p.c.m.
Tractor only	...	...	2·04 units p.c.m.

Thus the average energy consumption for a car and trailer is only approximately 30 per cent. higher than that for tractor only. The passenger seating capacity of the tractor was 78 and for trailer 46.

In 1912 a series of tests were carried out, when the average current taken for a tractor car was found to be 1·8 amps. per passenger, and for a tractor and trailer combined 1·22 amps., or a reduction of 32 per cent. per passenger due to the employment of the trailer car. The passenger seating capacity of the cars used for this test was tractor 62, and trailer 46; the cars were loaded with sand to approximate fully loaded service conditions. It should be noted that the journals of all the trailer cars in London are fitted with radial ball bearings. Tests taken on the level showed the tractive effort at the drawbar to be 17·02 lb. per ton of load with these bearings, as against 38·03 lb. per ton of load when the journals were fitted with bronze bearings, and to this fact the low energy consumption can be partly attributed.

Co-operation of all Sections of a Tramways Undertaking.

When considering power expenses, it must not be assumed that the staff connected with the generation and distribution of electrical energy are alone responsible. The generating station staff really only has to deal with the economies which can be effected in connection with production, and reference must be made to those responsible for the consumption of the power so produced. For instance, the traffic staff are responsible for the proper and economical operation of the cars; the prevention of unnecessary stopping and starting, brakes being applied when power is on, reckless speeds, etc., etc. The rolling stock staff are responsible for proper equipment and subsequent maintenance of the cars—by neglect on their part the consumption of electrical energy may go up by leaps and bounds; items like trucks out of line, tight brake blocks, armatures on pole pieces, defective gears, defective lubrication, etc., etc., all require constant attention. Again, the permanent way staff may also be responsible for increasing consumption, due, *inter alia*, to rails not being to gauge, rails being so worn or paving so defective that motor cases drag on the road, or defective track, which may make it impossible to drive cars at an economical speed; dirty track, also power wasted when grinding or welding rails, etc.

It will thus be seen that all sections of a tramways department are responsible in some degree for the consumption of electrical energy, and it shows how necessary it is, if the best results are to be obtained, that not only should the officers co-operate and study the position from a broad point of view, but the employees in all sections should be brought into touch with the work as a whole by regular lectures and demonstrations. So far schools have been principally provided for the education of motormen in their duties. These should be extended, so that the education of all employees, as far as the tramways are concerned, may be made a strong feature of the organisation. Anything which makes the employees more competent and interested in their work will benefit the undertaking.

One wishes it was possible to institute some scheme under which the staff and the employees would have a direct financial interest in the success of the undertaking. This would have a very direct effect, not only in the reduction of power expenses, but in the whole financial results. It is certainly a matter which should be considered by the Whitley Council.

Power Supply from Combined Stations.

It is true that a large number of municipal undertakings obtain their power supply from the lighting department, but the Corporation representatives on this Association are not tied to one department in their municipal activities, and they should be in a position to judge whether the charge made by the lighting department for power supply to the tramways department is reasonable, and whether the lighting department is producing the power in the most economical fashion. Complaints are still heard that, in this connection, tramways are not treated fairly. Perhaps it is not generally known that a joint committee of the Incorporated Municipal Electrical Association and the Municipal Tramways Association was set up, and issued a detailed report "On Charges for Electrical Energy Supplied for Traction Purposes from Combined Stations" in September, 1911, but as changes may have taken place, and the tramway representatives may not be disposed to be so generous as they were in 1911, it would be advantageous if the basis of charge could be reviewed at the present time. The Executive might be instructed to take the matter into consideration, and if necessary confer with the Incorporated Municipal Electrical Association.

General Conclusions.

An endeavour has been made in this paper to show that, even under one head of account, such as power expenses, there are vast numbers of unexplored problems which are worthy of consideration with a view to effecting further economies, and thus proving that the anti-tramway cry that "tramways are dead" and "their day is done" is not true, and is only used by those who do not think, or by those who have induced local authorities to provide road tracks free of cost for the use of their free-lance passenger vehicles.

Tramways in the past have rightly or wrongly borne many burdens, and, when comparing one form of traction with another, it is necessary to consider the whole cost of providing the services rendered if justice is to be done. Even if the matter is judged on the question of power expenses alone, there is no cheaper form of vehicle on the streets of a busy city to-day than the electric tramway car.

DISCUSSION.

The President.—I now invite discussion on Mr. Fell's paper.

Alderman J. H. Palin (Bradford Corporation Tramways Committee).—Not being a chairman or a manager, I have very infrequently had an opportunity of taking part in your deliberations. I think the last occasion on which I was really a delegate was about 15 years ago, when the Association met in London, and we had the opportunity of inspecting Mr. Fell's station. However, I am very much indebted to Mr. Fell for his paper, because I got the unpleasant impression, on reading some of the papers beforehand, that they were left over from 1914. Mr. Fell's paper, however, is really up to date. It does really attack one of the problems which ought to be attacked at this conference, and I think I can promise Mr. Fell that, when his paper is published, it will attract a great deal of interest outside tramway circles. (Hear, hear.) The revelations which he makes with regard to coal are of very great importance to the general community, particularly the industrial community, because every manufacturer, every stoker or fireman that you meet has the same complaint with regard to coal that Mr. Fell gives us here to-day. The thing we want to know in the first place is where is all the coal that we got in 1914 going, and if the Government has any influence in its distribution, I do not think there is a single industrial concern in the whole country but what will be indebted to Mr. Fell for calling attention to the matter. It is also very interesting to me from another point of view, because I have been interested in tramways for, perhaps, 20 years or more, and I have always, when I have come to discuss problems, perhaps from the opposite side of the table to some of you gentlemen, pointed out that there is more than one question that has to do with works costs and wages. I congratulate Mr. Fell, who is probably the only manager in the country who has discovered that there are other items than wages in making up works costs in the generation of electricity. One difficulty about the first part of this paper is that there are only about three or four concerns in the country that have a generating plant of the size of Mr. Fell's, and where they could put into practice much of the excellent advice which he offers. As a matter of fact, I am quite persuaded that many of the tramways which are producing electricity ought not to do so, in the public interest, and if there is one thing in which I agree with the Ministry of Transport, it is that large works give the best results and, therefore, we ought to do all we can to get large generating stations which will reduce the cost of electricity, and to get representation as tramway authorities on the District Boards that are to be created. We must get representation in these boards as large consumers of current if the things that Mr. Fell is here laying down are to be put into practice, in order that we may obtain current at the lowest possible price. With regard to his remarks as to waste, I am much more deeply interested. Waste is abominable wherever it takes place, and I am just afraid that in the

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tramway industry, particularly in the large concerns where they are able to get their current at perhaps less than the smaller concerns, they did not pay regard to this side of the question until circumstances compelled them to do so. Nevertheless, it is the proper thing to do. Waste cannot be justified under any circumstances, but all the waste, as Mr. Fell very rightly points out, does not rest on one pair of shoulders. There is no doubt that the driver and the conductor can do a great deal to save electricity by close co-operation together, but I hate bonus schemes as I hate the devil, because my experience of them is that they produce those petty jealousies which bring results the reverse of co-operation between the staff generally. Of course, we cannot say anything with regard to trailer cars in Bradford, because in Bradford and places like that trailer cars are out of the question. With regard to the co-operation of officials, I am satisfied, from practical demonstration, that Mr. Fell is on the right lines. Many years ago, when Mr. Spencer was our general manager, in Bradford—I am pleased to see him here to-day, and taking an interest in the municipal undertakings still—he did some very effective work in this connection, not only by the introduction of current meters, but also by overhauling the car shed staff and seeing that it did co-operate with the motorman and conductor, because the meter, in the first instance, called his attention to many things which he did not previously suspect. Both with regard to the alignment of wheels and various other things that Mr. Fell has enumerated, and also particularly with regard to the permanent way, Mr. Spencer did valuable work, and I believe I am right in saying that he even went so far as to get a standard gauge and had it sealed up, so that the platelayers could test, from time to time, their gauge. There was a good deal of current saved in that way, but it does require the co-operation of all parties. How are you going to get that ? You will only get it by education, and I would like to remind you, gentlemen, that there has been established in connection with your Industrial Councils a proposed Works Council, which, up to now, has not been effective. The idea of the Works Council is that the manager should meet his men from the department and not only hear their grievances but also put before them matters affecting the department, but that has not been taken up with any enthusiasm on either side. Nevertheless, it seems to be the means by which this national work should be commenced. At any rate, it does form the nucleus of an organisation to commence this work, and I am quite convinced that the financial results will be very great. This is one of the things—it may only be one of the smaller items—which affect the financial results, and from the small experience we had in Bradford before the war I am quite satisfied it is worth while. As a matter of fact, until the days of our poverty we did not pay regard to these things. When I was serving on the military railways in Belgium, until the Germans began to torpedo our ships and prevent us getting coal for our locomotives and petrol for our tractors, we never thought of saving anything ; but it was remarkable, when we were compelled to save, how much traffic we moved with only a modicum of fuel compared with what we had been previously allowed ; and I am quite satisfied, with regard to municipal tramways, that this question of saving current ought to be taken up with the greatest enthusiasm, and then we shall be able to serve the public interest by really carrying our passengers at the lowest possible cost.

Mr. C. J. Spencer (past president, and now manager, Metropolitan Electric Tramways, the London United Tramways, etc.).—With your very kind permission I should like to follow my friend, Alderman Palin, in the discussion on this excellent paper by my old friend Mr. Fell. Mr. Fell, very properly, in these times, draws our attention to things which tend towards economy, and it is, of course, an important item to consider what economies can be effected in the cost of power consumption, because, second to wages, power consumption is, I believe, one of our largest and most expensive items. I do not think it is quite true what my friend Alderman Palin suggests—that Mr. Fell is the only manager who has recognised that wages is not the only item which has increased since the war. It is true to say that wages have increased, perhaps, more than any other commodity, but it is certainly true to say that the wage bill is the biggest and most important item and, therefore, we very properly look upon it most seriously. In his paper, Mr. Fell has mentioned the bonus scheme which the London County Council adopted during the war, and I am very disappointed to hear from Mr. Fell that the result of that bonus scheme up to date has not been a great success. There again I join issue with my friend, Alderman Palin, on the question of the desirability of a bonus scheme, and I will give my reasons. I have a Works Committee. We do not call it a Works Committee, but apart from the name it is a Works Committee, in which the manager and men meet monthly to discuss problems. During the war, when very great pressure was put upon all tramway undertakings to economise in fuel, a bonus scheme was put into operation on one of my companies with the object of reducing the current consumption, and it was remarkably successful. When this scheme was put into operation a meter was fixed to every car, and each man was individually responsible for his own consumption. The current consumption went down from 15 to 20 per cent. Since the war there has been a very considerable increase in wages, as we all know, and it was suggested by these men that the bonus scheme might be abolished and, in place of the bonus scheme, the wages increased. They said—and they used exactly the same argument that Alderman Palin has—that the bonus scheme was bad ; that it set up jealousies between the men ; that it was immoral ; and when a man was paid his wages it was his duty to do the best that lay in him for those wages. In pure theory I am sure they were right, and I agreed with them at the time that we would make the experiment and abolish this bonus scheme and accept their promise that the taking away of the bonus, which depended upon results, and the paying of a standard wage, which was not necessarily connected with results, would make no difference. We said we would put it in force and see what happened. Now we know what has happened. The consumption to-day is exactly where it was in pre-war days, and the 20 per cent. has been lost. Now, gentlemen, we may theorise as long as we like. We may wish to give adherence to some very fine theories, but we must not miss the facts when we see them ; and whilst, perhaps, the policy of the carrot before the donkey's nose is not a compliment to the donkey, the only alternative that I know is the whip behind, and the one or the other must be adopted. It is all very well to express fine sentiments about men in the mass, but we are all human, and I want to draw no distinctions between employees, managers, and committee men. If there is a little incentive to do a bit better, and if, by doing better, there is something substantial to be got, we are always certain to get results. I therefore join issue on that point. I am an absolute convert to the necessity of a system of payment by results as far as possible. At any rate, that is the result of my experience. Mr. Fell mentioned a very interesting matter, namely, the question of current consumption on trailer cars, and also, as a side line, that the trailer cars are fitted with radial ball bearings. I am much interested to hear that. Of course, this paper does not pretend to go into a lot of detail, but it is an important thing. If it is good policy to fit a trailer car with ball bearings, is it not equally good policy to fit a motor car with ball bearings ? And really, when we come to consider this subject very carefully, had we not better take to ourselves the blame of repeating to-day the practice of 20 or 30 years ago ; that we, as tramway men, are not looking far enough ahead and are not keeping level with the times ? Mr. Fell says, I believe quite properly, on the last page of his paper, that " there is no cheaper form of vehicle on the streets of a busy city to-day than the electric tramcar." I believe that is true. Our chief merit, as compared with our competitors, is that the tramcar, everything considered, is the cheapest vehicle to run, but it could be, in my view, a good deal cheaper if the amount of scientific application and the amount of brains that have been spent, let us say, on the development of the motor omnibus, were applied to the tramcar. We should then have very much better results, and, whilst I have only been speaking of ball bearings, that is only one item. There are a score of things which would immediately occur to the mind of any tramway manager which could, with very great advantage, be investigated, and it is the bounden duty of associations such as this to give their full consideration to the technical side of our duties, and to see just how far we, as tramway men, can take advantage of the great advances that have taken place in scientific matters connected with transport, even in the last few years. I believe we are on the verge of very great improvements. I was, only a few days ago, looking at the designs of a motor which, horse-power for horse-power, is less than one-third the weight of the best motor on the market, has an efficiency of nearly 10 per cent. more, is designed as a shunt machine and not a series, so that the car can be driven at any speed desirable, and has a worm drive and not a gear drive, therefore making for absolute gear silence. Without going into any further details, it is in these directions in which improvement is possible. I do not think for a moment that the present type of tramcar or the present type of drive is the last word by any means, and I hope we shall apply more scientific knowledge to our problems as we have them to-day.

Mr. R. G. Cunliffe (late of Manchester Corporation Tramways).—The attention of every person interested in the future of tramway work has, of late years, been concentrated on the financial standing of the various tramway systems in the United Kingdom. It is obvious that an increase must be made in the ratio of revenue to expenditure and such increase must be made chiefly by increase in fares charged per unit distance, but may be supplemented by economies in operation which are worthy of consideration. The past five years have produced revisions in design and construction which enable operating, maintenance, and repair costs to be considerably reduced, and post war conditions find, unfortunately, the tramways industry so financially weakened as to retard the development which would normally take place in line with the improvements available. Directions for the increase in economy lie in the

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extended use of motive power giving increased weight efficiency, reduced temperatures, improved insulation, greater power, and standardised construction. The heat treatment of steel offers a growing field in the extension of the life of wearing parts. Noise and vibration, two objectionable and wasteful features common to the older type equipments, can be reduced by the use of single helical gearing with teeth set at a small angle of 6 to 7½ degrees, so as to avoid excessive end thrusts. Such gearing is common to high speed, high power, turbines, and is in wide use for tramway equipments abroad, generally being heat-treated, forged solid and pressed on the axle owing to the life of the wheel being comparable with that of the axle. Shock and noise are eliminated by the sliding motion of the teeth in contact. Roller bearings for motors are receiving much attention and are now past the experimental stage. The object of their use lies in the increase of life, absence of rubbing of armatures on pole faces, and reduced lubrication costs and troubles. The wide use of sheet metal, whether steel or alloy, to replace expensive timber is open to consideration. Transmission losses in the feeding networks are now, relatively, of greater importance than hitherto, and there are many cases where economy could be obtained in their reduction. Coincident with increased charges for labour and materials is an increase in general in the energy consumption per car-mile, often without easily ascertained cause, but of almost paramount importance in the expenditure account. Energy losses at the equipment are cumulative and magnified in feeding systems, generating and boiler plant each, by its own inefficiency, magnifying the loss which ultimately results in increased coal consumption. These remarks are not intended as criticisms, but only as of a suggestive nature, and the competent observer need only observe the cars in the streets of may towns to note the possibilities for economy.

Mr. A. R. Fearnley (general manager, Sheffield Corporation Tramways and Motors).—Following the remarks of the last speaker, and on the question of operating costs, I would say that the points raised by Mr. Cunliffe have had a good deal of attention during the past six years. Despite difficulty in finance which we are experiencing, many of the municipal tramways have taken advantage of revisions in design and construction, and have largely adopted the new equipments which have been on the market for the last four or five years, thus obtaining the benefit of increased efficiency, reduced temperatures, and better insulation which the modern equipment provides. In regard to heat treatment of steel, tramways have made considerable use of this treatment to try and obtain improved life for wearing parts. There is a good deal of room for further experiment in this direction, as some of the attempts which have been made by both manufacturers and Corporations have not been too successful. The work is, however, being continued, and it is hoped that increased life will be obtained from tires, rails, and gears. In regard to helical gearing, this requires careful attention before further expense is incurred so far as tramway gears are concerned. Extensive trials have been given to various types, but up to the present we have not found any helical gearing which is a commercial proposition for tramway equipments owing to the short life. They certainly are much quieter in running, but have not justified the expense. We use the solid gear pressed on to the axle, but not because the life of the wheel is comparable with the life of axle, as the two never synchronise. Gearing which has been found most successful in the large works has proved in actual practice unsuitable for our purpose. Roller bearings for motors (and axles) still require careful attention, and we shall be greatly interested to hear the results of a further twelve months' use of this revision in design. Sheet metal has had an extensive trial in place of timber, but its use is not now being extended for this purpose. Transmission losses can be considerably reduced by well placed sub-stations, and this is a matter to which we are giving greater attention than in the past, although progress during the last few years has been very slow. Energy consumption per car-mile has been increased by a large percentage of raw motormen who do not carry out too well on the road the instructions which they have received in the school. In these days of heavy costs of materials and the increased cost of labour, it is desirable that every possible economy should be effected in the working of our systems, and our technical staffs have great room for practical work under the conditions now prevailing. We cannot, however, follow "stunts," although we are always interested in watching their progress and their life—short as it usually is. Generally speaking, the municipal systems have been soundly built up and carefully financed, and it is in a great measure due to this that they have met in such a reasonable manner the demands made upon them during the difficult period through which we have passed.

Mr. R. H. Campion (Chesterfield).—As one burning six times the amount of coke that I am coal, I thought you might be interested in hearing something about that. We hand-fire this coke, but unfortunately we cannot use the coke from gasworks, as we find that they take too much out in residuals before, and therefore I was particularly interested when Mr. Fell said that he used the coke from a neighbouring gasworks. We have found that we have to go to the coke-oven retorts to get this coke, but there is a method of burning coke which has not been touched on in the paper, and that is to mix tar with it. Tar is now getting rather a drug on the market, about the only thing that is, and I think if some suitable method could be devised of mixing tar with coke you would get much better results. My own opinion is that you will never get much from oil alone. I went into this question some ten years ago, when it was a matter of putting in oil engines, and then I found that the price of creosote oil delivered from the gasworks to a chemical manufacturer was 25s. a ton. I asked that man if he would let me have this creosote oil at £2 a ton after he had finished with it, and if he would make an agreement for five years. He said "No fear!" He still hoped to get more by-products out of that tar oil that he was receiving from the gasworks. With regard to bonuses, I have tried three bonus schemes with a Council I was employed by, and they were all turned down. In the last one I left myself out of the bonus scheme, thinking that perhaps that was the drawback to it—(laughter)—but even then, although the committee agreed with me that the thing was essential and necessary, they said it would operate so badly over every other department of the Corporation. They therefore left it alone entirely, and turned it down. Since then I have given bonus schemes a miss, but I do think that, in the stoke-hole, if CO_2 recorders can be manufactured to give reliable results without too expensive a staff to attend to them, you will get stokers to take an interest, and they do take an intelligent interest as long as the CO_2 recorder works efficiently and well, but I am rather digressing on that. With regard to roller bearings, there is a man in this room who started on roller bearings for a very big firm over twenty years ago. He can tell you pretty well the result of the trouble we had with these roller bearings, though, of course, roller bearings have improved enormously since then. But anybody who had experience with roller bearings at that time had a very bad time indeed. As a matter of fact, it is not always efficiency that pays. It is commercial efficiency you want. You do not want a tramcar with a bad roller bearing holding up a whole system, because that is the trouble on a tramway system. It is not like a motor omnibus, which you can put on one side of the road and get it out of the way. One tramcar blocks the whole system.

Mr. A. L. C. Fell, called upon by the president to reply to the discussion, said—There are hardly any points that need reply, and I am very gratified with the very interesting discussion that has taken place on the paper that I have been able to submit.

The President.—It is my pleasure to move a very hearty vote of thanks to Mr. Fell for his paper.

The vote of thanks was carried with acclamation, and the conference then adjourned until Thursday.

SECOND DAY.

Sir John Courtis again presided over the conference on Thursday morning, and in opening the proceedings said—The first paper is one by Mr. Dalrymple. I am sure you will all be sorry he is not here to read his own paper, to hear the discussion upon it, and to reply to any points raised. Mr. Beckett has undertaken to read his paper. I should like to read a telegram in reply to the one we sent to Mr. Baker, of Birmingham, yesterday. Mr. Baker says—

> "Deeply grateful for your kind message. Trust conference will be a great success. Hope soon to be back again amongst my colleagues.—Baker."

The following papers by Mr. Dalyrmple and Mr. Horsfield were then read.

REPAIRS AND DEPRECIATION IN RELATION TO CAPITAL AND REVENUE.

By JAMES DALRYMPLE
(*General Manager, Glasgow Corporation Tramways*).

Although I find that it will be quite impossible for me to attend the conference at Cardiff, as desired by the secretary, I have gladly put together a few notes on the above subject. During the past few months I have had ample opportunity for studying the financial position of a large number of tramway undertakings, which are owned and operated by both companies and municipalities. I have invariably found that where the financial position is shaky the cars and other plant are generally very much worn and the track very rocky. The reason for this state of affairs, we must assume, is that those tramway authorities have not the necessary funds to keep their undertaking in a proper state of repair, and, generally speaking, when we turn to the balance sheet of these undertakings we find that there are no funds in the renewal and depreciation account.

Some people nowadays seem to have a great aversion for the word "capital," and it is extraordinary what opposition is en-

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countered when one suggests that our capital must be maintained. There are many municipal authorities to-day who seem to be quite prepared to give the very highest wages to their employees, but who, at the same time, entirely overlook the fact that in a short time their capital, as represented by the track and equipment, is rapidly going out of existence, and that the time is fast approaching when there will be no track and no equipment capable of earning revenue either for wages or for anything else.

I have always held the view that in operating a tramway undertaking, whatever happens, the capital must be maintained, and this can only be done by keeping the concern in as complete a state of repair from day to day as possible, and, in addition, setting aside from year to year whatever amount of depreciation has taken place during the previous twelve months. It may be said, and it is very frequently said, that the sinking fund should be sufficient to take care of depreciation, and that as depreciation is not, generally speaking, a statutory charge, the revenue should not be made to bear this burden.

My understanding is that the legislature intends that, by a given date, the debt on the undertaking should be entirely paid off. I do not think that it was ever contemplated that there should be a perpetual debt on any municipal undertaking.

I have recently been going carefully into the physical and financial condition of many tramway undertakings. The position generally is that the revenue has not been sufficient to meet the increased wages granted to the staff, and at the same time enable the undertaking to spend what was required on repairs, and I find that it generally follows when you have too little spent in repairs you have nothing available to meet depreciation and renewal.

Mr. James Dalrymple.

Many tramway undertakings throughout the country are in a good state of repair, and have considerable renewal funds. I find, however, some undertakings in which renewals are being added to capital. I find others where too little is being placed to the renewal and depreciation funds, in order that a sum may be available for the relief of the rates. I find some other undertakings where the plant and equipment are being starved to obviate the necessity for an increase in rates. I find other undertakings where the renewal fund has been actually depleted in order to relieve the rates. In all the instances above referred to, the tramway capital is being tampered with in order to meet the current administrative expenses of the municipality.

The two largest items under the heading repairs and maintenance are, of course, track and rolling stock. The repair of the track, of course, costs more on some systems than it does on others; very much depends on the way the track has been originally laid. The nature of the ground also under the foundation is a very important feature. Some of us who are troubled with mineral workings know this to our cost.

The renewal of the track, which on a congested system occurs very frequently, is giving many of us much concern. Hitherto we have been reckoning on an average cost of about £4,000 per mile of single track, whereas the actual renewal is coming out at nearer £10,000. This increased cost has to be met in some way, and I would put in a very strong plea to-day for the maintenance of our capital, and this can only be done by keeping our system in thorough repair, and by setting aside ample funds to meet renewal.

We have under our care undertakings which could not be installed in these times for less than three times their original cost, and I would be very much surprised to learn that there is a single tramway undertaking in the country which has provided sufficient to meet renewal and depreciation. All tramway undertakers should at this time go very carefully into the physical condition of their plant and equipment, and budget for their future requirements to keep that plant and equipment in a condition capable of earning the necessary revenue.

A number of municipal tramways systems are, and have always been, in a hopeless position financially, and will likely remain a charge on the rates, but I think it is generally agreed that the tramway passenger should pay for his ride. The revenue from fares should therefore be sufficient not only to meet all running expenses and keep the plant in good working order, but also to meet all charges for interest and sinking fund and to provide a fund to maintain the undertaking.

It is the last item, viz., the amount which is now necessary to lay aside to meet renewal and depreciation, which we should now consider very carefully. Some authorities are setting aside a fixed figure per car-mile; others are setting aside whatever sum may be available for that purpose, however inadequate they know that sum to be. Many, of course, are not setting aside anything at all, simply because there is no money available.

This question should be faced boldly, and the revenue of each year made to meet the outgoings on both revenue and capital accounts.

REPAIRS AND DEPRECIATION IN RELATION TO CAPITAL AND REVENUE.

By R. L. HORSFIELD
(*General Manager, Cardiff Corporation Tramways*).

Renewals and Depreciation.

The question of depreciation and renewals has on many occasions been considered by tramways committees and councils of the various authorities represented by the members present here to-day, so that I do not think any preliminary observations by way of introduction from me are required. I therefore propose to get to the subject at once, and in order to avoid confusion I will put forward definitions of two funds which discharge separate and distinct functions, although they are sometimes regarded as interchangeable.

I refer to (*a*) A sinking fund, and (*b*) A depreciation fund. A sinking fund is established for the purpose of redeeming debt within the period of time prescribed by the sanctioning authority, and by its means we may say that municipal property is obtained. It may well be named the "property acquisition fund." A depreciation fund is established for the purpose of restoring property, and may be called the "property restoration fund."

Now, so far as tramways are concerned, if the last-named fund is abolished, or never established and cared for, we must be prepared to recognise and acquiesce in perpetual indebtedness, for it is obvious that we should not have an undertaking debt-free at any time. The distinction between these funds therefore is not one in name only, it is one of principle.

Provision for debt redemption only, within the assumed useful life of the asset, is not prudently sufficient. There is a gradual wasting of the asset due to wear and tear, which cannot be met by current repairs charged to revenue annually, and it has been the experience of most tramway authorities that for certain portions of the plant, and in particular permanent way, the loan period has not in the past been fixed well within the actual life of the asset. Let it be clearly understood that a sinking fund is not also a depreciation fund. It is therefore not only desirable, but of the utmost importance, that proper provision should be made to meet future necessities, as well as contingencies. The depreciation fund is not only the tangible expression of municipal thrift, it is to-day's recognition of to-morrow's demands, and it will be neglected to the certain detriment of our undertakings. This fund should stand apart from capital redemption, and should be jealously guarded and kept inviolate.

On the other hand, it should stand definitely and continually related to the revenue account. The declaration of so much "profit" without any provision for renewals is somewhat misleading. For wasting assets, that cannot be restored yearly, some provision should be made in the net revenue account, and no balance surplus should be treated as "profit" until that has been done.

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Alternatively, and by way of a minimum requirement, provision should be made annually, and accumulated, for obsolescence.

No prudent undertaking should absorb annually every available £ without paying due regard to the demand which future years will almost certainly bring with them. The hand-to-mouth policy is fraught with possible grave consequences. Therefore I put in a plea for sound finance, and the constant strengthening of our resources—at the very lowest that there should be precaution against contingencies.

Each year should stand by itself, and from the revenue of the year there should be provided not only the proper share of debt charges, but sufficient to replace the undisclosed wastage which takes place within the year. The predominant question is, not what are we able to set aside from the revenue of the year, but what is the amount necessary to maintain the undertaking on a proper financial basis? This is not an academic question. It is a sane business demand.

It is not equitable that next year's passengers should be called upon to pay part of the fare of to-day's passengers to the extent of the diminished value of the asset for which no provision is made this year.

Present day conditions serve to emphasise most strongly the wisdom of those authorities who have in the past prudently made provision for renewals, and it is clear that with the altered values as we find them to-day, the provision which was thought to be necessary in pre-war days must be considerably augmented to-day.

Mr. R. L. Horsfield.

The statutory powers for establishing depreciation or renewals funds vary with different authorities, but in many cases they provide for the accumulation of such fund up to an amouut not exceeding one-fifth of the aggregate capital expenditure. This is a very useful provision, but it scarcely meets the circumstances.

The county borough of Walsall, with which the writer was until recently connected, and had the honour of inaugurating and directing their tramways undertaking for a number of years, had in their Local Act of 1900 a clause similar to that above mentioned. The tramways committee wisely took advantage of this power, and accumulated a renewals fund, which in the year 1918 had reached its statutory limit. When they were promoting a Bill for further tramway and omnibus powers in 1919, in view of the increase in costs of material and labour, which apparently are to remain more or less permanent, I advised them to seek authority to increase the maximum of their renewals fund allowed under the Act of 1900. The local legislation committee before whom the Bill was considered appreciated this wise precaution, and granted a clause making the maximum two-fifths instead of one-fifth.

When I took up my duties in Cardiff I was pleased to observe that the tramways committee had observed a similar cautiousness, and had made due provision for renewals of track and other portions of the plant, and at March 31 last had accumulated funds for this purpose to the extent of £182,690. In common with other undertakings we shall require to look closely and continuously into the whole question of depreciation and renewals, so that these funds may be built up to meet the circumstances which present day conditions impose upon us.

It may be interesting to observe here that the Orders under the Act of 1920 for increased fares require an adequate fund for "renewals." The actual terms of the clause that are inserted in the Orders reads—

> "The Corporation shall make reasonable provision for the proper repair and renewal of the undertaking."

It is germane to consider the position of those authorities that have no provision whatever (and unfortunately there are many such cases), that have piled up a debt that will outlive the assets, and the burden of which must be borne in future years by either tramway users or ratepayers, who can have no option or voice in the matter, nor can they share any benefit from the burden that is thus thrown upon them. All such cases are object lessons that cannot be mistaken.

It is noteworthy that with some authorities a tendency is springing up to borrow for renewals, which has the undesirable effect of keeping the maximum of debt alive, and it is to be hoped that this tendency will be checked at its inception. It should, in my opinion, be discouraged, for in the event of obsolescence or supercession of plant, the authority adopting that course will clearly find itself in financial difficulties.

To the extent to which we abandon prudent methods of financing tramway undertakings. to that extent shall we inflict injury upon the stability and strength of the credit of local authorities, which has been achieved through years of communal thrift, and cultivated zealously by those who have preceded us.

It is not enough to declaim against to-day's high prices. It seems probable that the pound sterling is definitely and permanently devalued. It may not again possess the same purchasing power as in 1913, for example. We must therefore recognise a new (and probably permanent) level of prices, and familiarise ourselves with new heights of costs, of wages, of salaries, and of everything we buy and sell, and as our business is to sell rides on tramways, we must see that the sale price is sufficient to cover not only working expenses, but debt redemption with a plus, and that plus is well expressed by the term "depreciation."

My purpose in writing these notes is to stimulate an interest in one aspect of finance of tramways which may not be popular, but cannot be lost sight of by any authority without injury which cannot easily be repaired. It requires some courage on the part of any committee to tackle it in adverse circumstances.

DISCUSSION.

The President.—These two papers are now open for discussion.

Alderman Fenton (vice-chairman, Sheffield Corporation Tramways).—The two papers that have been read this morning afford a great amount of food for thought. In referring first to Mr. Dalrymple's paper, I should like to say a word or two with regard to the question of relief to the rates. I think there is a great deal to be said in favour of what Alderman Smith said yesterday, as to an amount of money being placed to the relief of rates. We in Sheffield have held the opinion during the whole course of our experience, since we took over the tramways, that those who found the credit for supplying the money to start the tramways ought to have some return from it, and therefore there should be something to go to the municipal coffers as a return for the credit which has been placed at the disposal of those who benefit by the tram rides. In the past we have been enabled to do so year after year, and this is the first year that we have not been able to apply any sum whatever to the benefit of the rates, and as far as I can see, there is very little probability that any tramway undertaking, for some time to come, will be in the happy position of enabling the general body of ratepayers to receive any benefit from the tramways which the ordinary rider enjoys. But the main point I have risen to speak to you about is one that is not mentioned in these papers; it is only referred to casually. It is, however, a very important item in connection with the running costs of tramways to-day, and one which, in my opinion, will become still more important in the future, even than it is at the present moment, and that is with regard to the repair of the tracks. At previous conferences I have brought forward this question, and, indeed, on one occasion I read a paper on the obligation of tramway authorities to pay for the renewal of the paving of the tramway track. Although circumstances have so completely altered since the passing of the Tramways Act—when the Tramway Act first imposed this obligation upon tramway undertakings they were all horse-drawn tramways, and consequently the wear and tear on the setts was very largely due to the tramways themselves—although that situation is entirely changed owing to the gradual introduction of mechanical traction, the state of affairs which has existed since, owing partly to the war, and owing partly to the natural transformation of horse to motor-drawn traffic, generally, in the streets, has made the position an extremely acute one. I think we shall all agree that the position, so far as the tramway under-

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takings are concerned, is an unjust position. (Hear, hear). That a tramway undertaking should have to bear the burden of repairing the setts between and for 18 inches on either side of the tram rails, when they actually do no damage to these setts in the slightest degree, and when the wear and tear put upon these setts, and not only upon the setts but often upon the rails themselves, is considerably accentuated by the heavy motor traffic now coming upon the streets, which on so many occasions runs upon the track and wears not only the track but the setts to a very great extent, at the expense of the tramway authority, is a very unfair thing. Now, gentlemen, I am not in favour of subsidising any kind of municipal affair, no matter what it may be. I think every municipal undertaking ought to stand on its own legs; it ought to be able to pay its own way, and I do not think it is fair, mark you—I expect there are some delegates here with divided allegiance, those who are members of Highway Committees as well as on Tramway Committees—it is distinctly unfair that the municipal authorities should be able to make the tramways bear a burden which it should not. I do not say anything about what the position was at the time of the Tramway Act, but at the present moment they should not have to bear the burden of keeping the road in repair, because that rightly belongs to the highway authority. You may say that it is only taking the money out of one pocket and putting it into another, but I do not agree even with that, because tramway fares, about which we had so much talk yesterday, are dependent on what it costs to run the tramways, and as I have said before, that undertaking, like other undertakings, water, gas, and electricity, should stand on its own legs. It is only fair that it should have its right charges debited against it, but I think the time has come when the cost of maintaining the tracks should be put upon the right shoulders. If that were done, it would very largely help the tramway authorities to solve the difficulty with regard to fares. If the Executive of our Association would take this matter up they would find a sympathetic audience in the House of Parliament to-day, because, after all, the cost of tramway transit is a most important factor in securing the welfare of the working classes in the desirability of placing them as far as possible away from the smoke of the centres of the towns where they have to work, and putting them in purer surroundings. We have got to that economic pitch, almost, that something will have to be done in that direction, and the views I have brought before you this morning I trust will receive careful consideration in dealing with the subjects which have been brought before us in these admirable papers.

Alderman Smith (Liverpool).—What I want to know is whether anyone can tell me definitely—Mr. Dalrymple says the rider should pay for his fare—if there are any halfpenny fares in Glasgow, and is the halfpenny per mile for each mile and all the miles, or exactly how it is. I have not found anyone amongst our friends here who can tell me definitely.

The General Secretary.—The halfpenny fares in Glasgow have been abolished. There are no halfpenny fares in Glasgow now. What they have done is to compound between a halfpenny and a penny and issue one dozen tickets for 9d., which are available to various shops, milliners, and others, and the shopkeepers are allowed a commission on their sales of tickets.

Alderman Palin (Bradford Corporation Tramways Committee).—As one who has studied the various papers read before these conferences for about 15 or 16 years, I realise what has been said this morning has been said, perhaps not quite so effectively, years ago. It is perhaps quite necessary and proper that the law and the prophets should be read over to us from time to time lest we forget, but my difficulty in approaching the discussion this morning is that those authorities who have carried out the law and the prophets, that have not wasted their substance in riotous living, and have fully credited the reserve and renewals fund with what they could reasonably anticipate would meet their requirements, find such sums totally inadequate. Unfortunately there has been a war, and values have altered considerably with the result that the local authorities who have provided what they considered adequate sums for reserve and renewals and the rest of it, now finding that the sum is totally inadequate for the purpose, are faced with two alternatives. They have either got to charge such a fare to meet the difficulty that nobody would pay it, or borrow, because after all is said and done, you are not so absolutely essential to the life and well being of the nation as the railways, for instance. The tramways in many localities are a very great convenience, but if the cost is to be too great, they can be done without to a very large extent, and you have incurred such a large capital expenditure that if you were to kill the goose that lays the golden egg, you would still have that to pay. What are you to do? It seems to me that where your track has exceeded its life and you can properly borrow, there is no reason why you should not borrow. To put it in a way a member of our Council put it some years ago, "It is all right talking of posterity, but what has posterity done for us"—(laughter)—and I am convinced of this, that to ask the present generation to bear the whole cost due to the war is extremely unfair, and you are placing a burden on the present generation which you know perfectly well it cannot bear. Therefore, under these circumstances, where your assets have been repaid you could start as though you were starting a new tramway system, and if some other mode of traction was then developed which made tramways absolutely obsolete, the municipalities would not be on their backs, because they would not have to find the money. They have only to find the credit, and if you were to start a new system to-day it would involve a new type of rolling stock and no permanent way. Then, of course, you would do the same as you did at the beginning. Your credit is there—at least, it is so in Bradford—and you can start afresh just in the same way as you started to run tramways. The question of paving is a matter that the Executive of the Association ought to take up very strongly with the Ministry of Transport. It is not a case, I submit, as between the Highway Department and the Tramway Department to-day. Our difficulty is this, that not only have we to pay for paving in between the lines, we have to provide reinforced concrete in towns where there is very heavy traffic, in order to bear the extra strain of that traffic, and the whole cost falls upon the Tramway Department. Tramways are mostly laid in main roads, and what we ask is a measure of justice from the Road Board to enable us to maintain these roads on the same lines as grants are made for the improvement of other roads. There is no earthly reason why a tramway should pay for the damage done by lorries weighing many tons, because these not only damage the setts, but also the bed, and while one cannot estimate the total damage, yet we can estimate it sufficiently to put in a claim for a grant from the Road Board to meet the cost of keeping in condition a main road where traffic such as I have described runs. Now that each motor vehicle is paying something in taxation towards the upkeep of roads, we have to see that we have justice in this matter and get our share from that taxation. I think that is all there is to be said on that aspect of the question. The small authorities who are in this unfortunate position should have some light and leading from this conference which will enable them to solve their difficulties; otherwise, the conference very largely fails in its purpose.

Mr. H. P. Stokes (general manager, Plymouth Corporation Tramways).—There is one point in connection with this question of road charges where I think the municipalities may very considerably help themselves, especially where a tramways undertaking is operating motor omnibuses. In these cases it is the invariable custom of another department of the Corporation—the Highways Department—to inflict a charge per omnibus-mile for the running of the omnibuses on the roads, and in our own particular case that charge is 1½d. per mile. We are carrying on something of a war at the present time between the two committees of the Council as to the justice of this charge, particularly in its application to those roads on which tramways are laid, and over which we are also operating motor omnibuses, because it does seem to me grossly unfair that, whilst the Tramways Department maintains practically the whole width of the road as the result of having laid down tramways, it should, when it desires to use a different type of vehicle over that road which it already maintains, have to pay another department 1½d. per omnibus mile for the privilege of using it. If municipalities were to take a sensible view with regard to this matter—and we hope to get a sensible view taken locally—it would have a considerable effect in supporting our claim for tramway relief now. A greater national aspect of this matter is taken by the Ministry of Transport, but it is essential that this should be dealt with as far as possible at the present time before the new motor taxation comes into operation, so that we shall establish a precedent and a definite claim for consideration from the Ministry of Transport next year. With regard to the point which is raised in Mr. Horsfield's paper on debt redemption, the suggestion is more or less made there that no undertaking ought to carry out renewals by means of raising fresh capital. Personally, I hold a rather different view on that matter. (Hear, hear.) If one considers any commercial enterprise we find that they raise capital by means of shareholders, and the general intention is to produce a revenue so as to give those shareholders some return for the money they have invested. In the case of municipalities, you use the credit of the municipality for finding the money, and you pay interest on that money, and, at the same time, return to the municipality actual money to the extent of your debt redemption, and that is a very definite return, inasmuch as it increases the credit of the municipality. (Hear, hear.) It is one of those things which invariably the ratepayers entirely overlook, and there are a number of undertakings in the country which are now getting somewhere near the period when their original debt will be entirely redeemed. In the case of the Plymouth tramways, which were originally bought by the Corporation, next year we shall have entirely wiped out the original debt of the Corporation. We are saddled with a further debt in regard to the purchase of another company, which still has to be met, but I do contend, now that the original debt is paid off, that we are entitled to carry out our

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renewals by means of new capital. If the undertaking itself had to provide the whole of the money which is necessary to renew the undertaking, then you are inflicting a burden on the ratepayers at the present moment which is going to be enjoyed by the ratepayers of the future. Certainly adequate provision ought to be made for renewals to maintain efficiency, and one of the things which ought to be dealt with strongly from the Association's point of view is the habit some undertakings have of existing on capital and depreciating it to such an extent that there is no life left in the undertaking, and leaving posterity to pay off the debt which has accumulated, because the revenue earning capacity has been so seriously depleted.

Mr. W. Murray (general manager, Walthamstow Council Tramways).—The last two speakers have put the case very fairly and clearly as it affects the small undertakings. The fact is that many of us cannot possibly make the provision for renewals suggested in the papers, without making a fresh call either upon the ratepayers or upon the tramway passengers. The question is whether that call for such a purpose would be fair and just? Nay, I put it on stronger grounds, would it be quite honest, that such a call should be made? Mr. Dalrymple states that the track and rolling stock ought to be kept in a thorough state of repair; and the question is, having done that, as most of us are trying to do, would it be fair to call upon the present generation to provide for the next generation an entirely debt-free tramways undertaking. What is the position? Suppose we borrow for 30 years for the construction of a tramway system, and we make provision for the redemption of the debt within that period, and meet the interest demanded; supposing the whole of the undertaking went absolutely to pieces, so as to be worthless at the end of the loan period; would there be any unfairness or injustice inflicted on the next generation? (Voices: No.) I say no. But, further, it is simply impossible for any tramways undertaking to so utterly collapse. You purchase land, and in many cases that land is much more valuable to-day than when it was bought. You erect buildings, which do not perish in 30 years—many of them are as good to-day as when first put up. You build bridges, make road widenings, and other improvements, assets which will be handed on to our successors. Many of them are practically imperishable, and will be there for all time; so that if those other liabilities with regard to rolling stock and permanent way were utterly worthless as assets to our successors, they are still reaping some rich reward from our efforts in these times. Then Mr. Dalrymple suggests that our equipments should be maintained in perfect repair. In normal times we do that fairly well, but of late it has been impossible. In Walthamstow our cars have been running for 15 years, and we have been for some time rebuilding them; and, profiting by past experience, I venture to say that they are stronger and better to-day than when we first received them from the contractors. Further, we have in many cases not only renewed the track rails, but we have also renewed the foundations, with reinforced concrete; and where there were formerly 6 in. of concrete we have now put in 12 in. All this has been done out of revenue; and I say it would be grossly unfair under present conditions, when we are already making a call on the rates, or will be, and when our reserves will soon be exhausted, if we have, as some others have, to saddle the present ratepayers with further calls for renewals, which ought to be the burden of the coming generation.

Mr. J. M. McElroy (general manager, Manchester Corporation Tramways).—The writers of the papers have set out certain ideals which, if they could be carried out, would be excellent for everybody. When Parliament permitted local authorities to construct and work tramways, they put upon them certain obligations as to how they must deal with their revenue. First, they stipulated that from revenue you must pay ordinary working expenses; then you must meet the interest and sinking fund charges; and then you may (if you think fit) provide a reserve fund to meet any extraordinary expenditure or contingencies that may arise. In other words, you may provide a renewals fund. If, after making all these charges, anything is left it must be handed over to the city in relief of the rates. That was the policy laid down by Parliament. Some undertakings in the past, before the war set out with the ideal that if they could pay off their debt and set aside such a sum as would meet all renewals quite independently of the debt, that was the right course to pursue. Others did not pursue that policy because they could not—their finances would not permit it. Now, the entire outlook has changed. We have had a great war and it has upset the whole of the calculations of those of us who set out with high financial ideals. If, in the future, having regard to the high cost of renewals, we have year by year out of the fares which are now charged to set aside such a sum as will meet the whole of the renewals independently of the repayment of capital, we are up against a very big problem, because, before the war those undertakings which were setting aside sufficient to pay, say, £4,000 per mile for track renewals, now find that the renewals are going to cost £10,000 or more per mile. Are we going to ask the passengers who are riding now to pay such a fare as would meet the deficiency in the renewals fund created in pre-war years, in addition to what is coming on to-day? I submit that is impossible on most undertakings. We must be a practical people. We have had a great war, and it has made a great difference to the finances of every undertaking. It has been the policy of some undertakings to provide large sums for the relief of rates, but in the altered circumstances, this places very serious obligations upon those undertakings who attempt it now. The high ideals which are so ably put forward by the writers of the papers will, I think, have to go. We shall have seriously to consider some time or other—particularly for the smaller undertakings—the question of reborrowing to make good the wasting assets in respect of which provision has not been made in times gone by.

Mr. C. Furness (Blackpool).—With regard to reborrowing, I should like to give you a concrete case. We have in Blackpool renewed practically the whole of our track, at a cost of something like £280,000. Approximately 70 per cent. of the capital of the undertaking has been redeemed. Do you think we are going, out of our renewals fund—by the way, it is not capable of meeting that expenditure—to pay for these renewals? It is not entertained in Blackpool that we shall renew our track out of revenue. We propose to reborrow new capital for the 70 per cent. that has been redeemed, and that is the policy which I advocate should be followed by the majority of municipal tramways represented here to-day. Many tramways have been in existence 20 to 25 years, and have paid off 60 to 70 per cent. of their original capital, and we in Blackpool propose to borrow new capital for the reconstruction of track to the extent of what has already been redeemed. There is more in these papers for chairmen and committee members than managers. I do not think there is much division of opinion among managers as to the right policy which should be pursued in connection with this matter, but unfortunately, when our members and representatives get into committee, they are generally persuaded to part with their surplus for the benefit of the Finance Committee or some other committee of the Corporation. I attribute this in a great measure to the term "profit," which is used in the abstract of accounts used by our municipal treasurers. It is a very misleading term —(hear, hear)—but it is a term which is fixed upon by members of Finance Committees throughout the country. They use the expression "profit," and to use a vulgarism, they collar it over the heads and against the advice of the members of the Tramway Committee. Therefore, I humbly submit that it is time our accounts were more standardised and brought into line to charge for renewals before we set anything aside or use the expression "profit." That would be a great help to the members of Tramway Committees when dealing with this matter in Council. We should not show a profit until we have set aside a sum for renewals. Otherwise, the accounts must show that there has been a deficit for the year if we are unable to set such a sum aside. Alderman Fenton made the remark that there was no damage to the track by the use of the tramways. It is a small matter, but I do not agree with that statement, because I think tramway managers will admit that there is disturbance to the surface of the road by reason of the tramway track, and surveyors will tell you that this is their experience. I do agree, however, that the time has come when the obligation of tramway authorities with regard to the maintenance of tracks should be borne more by the Corporation, through its funds, than through the Tramways Committee.

Mr. H. Mozley (Burnley).—How many years do they give you for the repayment of reborrowed money?

Mr. Furness.—We understand that we shall get at least 15 years for the reborrowed capital for track.

Councillor T. W. West (chairman, Walthamstow Tramways Committee).—I congratulate the undertakings which have been able to set aside huge sums, but whilst we in Walthamstow have not been able to do this, we have renewed the whole of the overhead equipment. There is, however, one point with regard to the renewal of capital that I do not think has been touched upon. Re-borrowing is all right, but it adds to the already high burden, because you have to repay the additional capital, with the interest upon it. It occurs to me whether there cannot be such a thing as occurred during the early stages of the war, when there was a moratorium on money; whether it would not be worth while seriously to consider deferring the repayment of the existing capital for a period and using that money for the renewals necessary to the track, because it does seem to me that by so doing you are decreasing your charges, or at any rate you are not increasing the already high charges. You would certainly extend the period in which you would repay the money you already owe, but the interest would remain on that amount of money. To re-borrow a sum of £200,000 or £300,000 is no light matter, because it appears to me that the charges you then have to meet and add to your already high charges are going to more than counterbalance what you take in extra fares, and I put it to this conference as a serious proposition whether pressure could not be brought to bear upon the Ministry of Transport, or whoever is the responsible authority for the time being for the

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repayment of capital, that we should have power to arrange to defer the repayment and let the interest go on, because I do think that for the present generation to have to pay the whole of these increased charges is like asking the present generation to repay the whole of the money the war has cost.

Mr. J. B. Hamilton (general manager, Leeds Corporation Tramways).—I rise primarily to speak on the point raised by the last speaker. His proposition, which he puts as appealing to our sense of fairness, is subject to this, that the whole financial structure of Corporations who have to borrow large sums of money is based upon their rating powers and the credit of redemption funds being paid at certain periods. If therefore it is proposed to alter, as he suggests, or defer the date at which the capital expenditure is to be cleared off by the redemption fund, you must clearly face the inevitable statement that a great deal of the money so obtained has been borrowed on false pretences. It has been a remarkable thing during the present stringency of money to find Corporations all over the country being able to borrow large sums of money often on better terms than even the Imperial Government, and that, I believe, is entirely owing to the fact that Corporations have honourably carried out the obligations imposed by Parliament with respect to their redemption funds. I think that is a complete answer to the point raised by our friend. It is a very sad thing to see our cherished ideals regarding renewal funds passing away, but I thoroughly agree with Mr. McElroy that many of them have to go. The circumstances in which we are now placed have entirely altered the position. On the one hand, we have our duty to the public; and yesterday I said a word or two upon that and getting the confidence of the public. On the other, we have our duty to ourselves, and this, I think, requires us, as tramway operators, to provide transport in the various towns at the smallest cost as far as we economically can, and to obviate such matters as impede our doing so. Amongst these impediments is the one which Alderman Fenton has properly raised to-day. There is no doubt, as Mr. Furness said, that the presence of rails in the streets causes a certain disturbance to the setts, but it does not cause wear to the setts to any appreciable degree, and it is to this extent only, I think, that tramway authorities should be charged with the maintenance of the surface of the roadway. The wear which is caused by other traffic, whether it is an omnibus or any other form of traction, should be a cost placed on the highways authority of the city. That is one of the things we must clear up before we can properly say we are endeavouring to provide our transport at its lowest possible cost. Another point which will come before us is the impossibility in many cases (as I have reason to know, for I have occasionally been consulted), the impossibility, unless you put up fares to what I believe will be beyond the economic limit, unless you impose fares which will very much reduce the number of your passengers, of carrying out those delayed renewals which have occurred in consequence of the great war. I think there should be some special means for obtaining loans to meet these exceptional renewals. Undoubtedly Government departments, not quite as interpreted by Mr. Dalrymple, are prepared to grant and in some cases I know have granted, a re-borrowing which covers the cost of the relaid track, this sanction depending, of course, on the payment into the redemption fund of any balances then unpaid. They have, of course, in such cases very properly limited the period over which such borrowing should be redeemed to something like the life of the particular portion of the asset for which the borrowing is required. That, I think, is another impediment which, if removed, will in many cases help those undertakings which have not the necessary surplus in revenue. These are two of the things which I think ought to be done in order to provide a correct estimate of what a tramway passenger costs for his ride. It may be said that tramway riding is not really necessary. It certainly is not as necessary as on long distance railways, but it is almost necessary to a large portion of the people whom we serve, and as soon as we can satisfy them that they are getting their transit as cheaply and as efficiently as it is possible to be got, then we shall get their confidence and the passengers and the revenue.

The President.—If there is no further discussion I will ask Mr. Horsfield to reply.

Mr. Horsfield.—From the discussion that has ensued on these papers they do seem to have created some interest. At the same time, there seems to be a difference of opinion on the question of re-borrowing. That may prove an expedient, but it may be dangerous, and the whole point of the papers was a plea for sound finance, and to have the whole of our undertakings put on a proper financial basis. With regard to our own undertaking, for instance, in Cardiff, I have some figures showing our capital indebtedness. At March 31 last the debt was £803,421, against which we have redeemed, through the sinking fund, over £431,843, leaving a balance of £371,578. In addition to that we have the depreciation fund, which I mentioned in my paper, viz., £182,690, yet in spite of the favourable position we appear to be in, we are seriously reviewing our whole financial position, and the whole purpose of the paper was to impress upon you in some way the importance of doing this now, in view of our present condition, a condition of high costs, and the present financial position generally; therefore I hope we shall benefit from the experience of this discussion.

The General Secretary.—Two or three points have been made on Mr. Dalrymple's paper which he would have replied to most effectively. One was the question of rate-aid from tramways earnings. Alderman Fenton has told us that there is something to be said for it. It was said that because municipalities borrowed cheaply owing to the strength of rate security and high municipal credit, the ratepayer should have some return for the advantage thus given to, say, a tramways undertaking. It is necessary to have some clear cut views on this question, which has been discussed for years. The fact is that municipal credit costs nothing beyond honest administration; but consider on what ground a ratepayer should derive a reduction of rates from an undertaking that costs him nothing. The principle underlying the method of financing municipalities is that each year is a separate unit, and stands apart from any other year. That is to say, that each year should bear the cost of the local government of the year. Suppose I were this year a citizen of Cardiff, for example; I ought to bear my share of all the expenses of this year, but not last year's nor next year's. I may be dead next year. It is reasonable to charge against tramways an annual sum in respect of cheap loans obtained, because something more than the tramways are mortgaged, but it is not reasonable to appropriate such charge in the reduction of the rates of the year. Such sum should be clearly accumulated in a fund to meet a contingent liability which exists so long as there is a loan debt, and which may fall upon some subsequent year, and not leave for a year of adversity the whole burden of some misfortune or calamity. That is at any rate prudent. I have no sort of right to reduce my rate burden at the expense of posterity. Alderman Palin asked about posterity and what they had done for us? But let me ask what our ancestors did for us. They accumulated huge resources, with no narrow view of their duty, which are now the pride and glory of the land. He referred to the "law and the prophets." What we are in danger of doing is to carry the profits to the rates, to keep the law, and for the rest do as we please. (Laughter.)

Another question was that of borrowing for renewals. It is not a safe expedient. It has its dangers. It will keep alive a constant debt upon tramways, and cannot anticipate the time when the undertaking will be debt free. It indicates the end of thrift, and is expressed as a policy in the old saying, "Let us eat, drink and be merry, for to-morrow we die." Our ancestors did not so act. (Hear, hear.) But why confine that policy to tramways? This City Hall, in which we meet, is being paid for in 60 years. It is certainly worth to-day several times the original cost. Why not go on increasing the mortgages upon it instead of reducing them, and apply the proceeds in reduction of rates? Such a course would be a complete reversal of our experience and traditions, and in my judgment would be fatal.

The question of an adequate renewals fund will have to be faced. To-day we are consuming our assets, which will require at least two and a half times the original cost to replace, and while we cannot expect to make up the arrears on that basis, we ought certainly to set aside funds on that basis, with the certain knowledge that we now possess. When the renewals on the higher scale take place that course will be necessary, and we shall do well to prepare for it. No doubt a higher annual charge for renewals will be required. Of course the provision of a restoration fund, as well as a debt redemption fund, is one of prudent finance. Following strictly commercial practice, it is obvious that when an asset is exhausted, and there is no debt remaining, nothing can be said against borrowing for the acquisition of further assets. Even then the provision of a fund for renewals, or contingencies against emergencies is necessary. Mr. Priestly has gone a step further than these two funds, and suggested a third fund for extensions out of earnings. Nothing would so strengthen an undertaking. Mr. Stokes has described it as dangerous. It is magnificently and heroically dangerous to say the least. Some of the strongest public companies in the country have built up their position by doing so. We are not in any such danger. The course advocated in some quarters is the reverse of that. It is to consume each harvest as it comes, and to take no thought for to-morrow. Mr. President, such a policy is, in my opinion, fatal to the high standing of municipalities in this country. It would seriously impair their credit, and should not be followed.

The President.—I am sure you will wish me to convey our thanks to Mr. Horsfield for his very valuable paper, and, although Mr. Dalrymple is not here, I know you will wish me to convey to him, through Mr. Beckett, how much we have appreciated his paper. You may be interested to know that the Executive have not been unmindful of the facts with regard to road maintenance, and we are taking steps to get a contribution from the Road Board.

The President.—We will now take Mr. Pilcher's paper.

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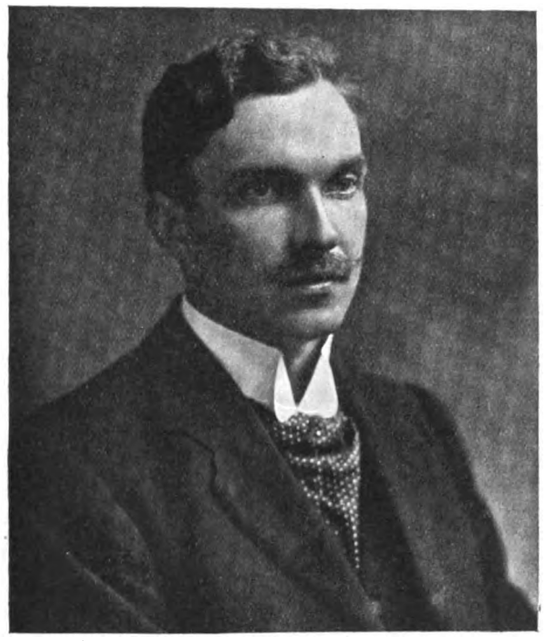
THE FUTURE OF CAPITAL EXPENDITURE.

By R. STUART PILCHER
(*Tramways Manager, Edinburgh*).

I have been asked by the Executive Council to make some notes on the subject of tramway capital expenditure with special reference to future prospects and its relation to competitive forms of traction. The papers which have already been read on working expenses and renewals have brought out very clearly the great increase in the costs of maintenance and renewals caused by the high cost of labour and materials, and the same causes affect capital expenditure to an even greater extent. The cost of some commodities required for the operation of a tramway system is only 100 per cent. up, but when we examine the costs of materials for the construction of permanent way and new cars, they are considerably higher. The pre-war cost of permanent way construction may be put at £12,000 per mile of double track; at the present time the cost is in the neighbourhood of £40,000 per mile of double track, this being over 230 per cent. increase.

With regard to rolling stock—in pre-war days single truck top-covered cars with the latest electrical and mechanical equipment could be obtained for £900 each. To-day these cars will cost approximately £2,800, or over 200 per cent. increase. I have recently had to provide top covers for the Edinburgh cable cars, which are at present costing £550 each. These could have been obtained in



Mr. R. S. Pilcher.

1914 for £120 each, and there appears to be no immediate prospect of the costs coming down for this class of work. The same abnormal increase applies to the construction of new buildings and to the provision of new plant, so that in this respect capital expenditure on new equipment or on new lines is very severely handicapped.

Capital expenditure requires new money, and money at present is only obtained at a high rate of interest. Pre-war money could be obtained at 3 per cent., now, even with the best security, such as the large municipalities can give, 6 per cent. is required. It is to be observed that the present price of the 1929-47 5 per cent. Government loan stands at £85 per cent. At that price it will yield a dividend of £5 19s. per cent. per annum, and if the redemption is added, £6 5s. It is not clear that even now the peak price of money has been reached. This is the logical effect of high prices; if the costs generally are over 100 per cent. up, we may expect that money will be correspondingly high. Private tramway enterprise will suffer more in this respect than municipal undertakings, because with the tramway undertakings being in embarrassed circumstances, money will be difficult to obtain until prices become stabilised and regular dividends are assured.

In considering this question we are therefore faced with the fact that new works require approximately 250 per cent. more capital for the same work, and that the rate of interest required is 100 per cent. up. The question of new capital expenditure would solve itself if the revenue to be derived from tramway undertakings could be made to increase in the same ratio as the working expenses. I think most of the transport undertakings have been on the slow side in raising the fares. The process of increasing the cost of travel must necessarily be slow and gradual, otherwise passengers will cease to ride or will ride less frequently. If the fares are raised gradually it will not be felt so much by the public; and the decrease in passengers carried—which is so noticeable all over the country—will be but a temporary state.

It is an extraordinary phase of the present public attitude that persons will willingly pay 100 to 200 per cent. for most commodities, but will not pay 100 per cent. increase on the car fares. In the course of time, I believe, the public will get over this, and will realise that the distance which can now be given for transport is only half what could be given in pre-war days. When this state is reached the financial position of the tramways will improve and the outlook for tramway capital expenditure will be more encouraging.

Although new tramway construction will receive a temporary set-back for the reasons I have enumerated, there never was a time when rapid and efficient transport was more necessary. As costs go up, time also becomes of greater value. There never was a period when the old adage "Time is money" was truer than it is at present.

What effect is the high cost of new construction going to have on transport? I do not think that the development of transport is going to be retarded. If tramways are to be temporarily restricted, more attention will be given to the forms of traction which require the least capital expenditure, and this brings me to the consideration of the motor omnibus. I do not intend to enter into a discussion of the advantages and the disadvantages of the motor omnibus compared with the electric car. This subject would require a paper to itself, but in speaking about capital expenditure one cannot but see the effect that high capital costs are bound to have upon the development of the omnibus. There is undoubtedly a great field for this vehicle, which can deal with extensions and new routes without any relatively great capital expenditure. How many tramway systems are there in this country where certain routes do not pay their way, and which have never paid sufficient to justify the laying down of the permanent way? It is probably cheaper to work those routes than to stop them, seeing that the capital has been sunk, but I believe that in the future when the question of the renewal of the permanent way has to be considered, many such routes will be worked by motor omnibuses or other railless vehicles.

I have recently worked out some interesting comparative figures for new construction of tramways compared with motor omnibuses in the city of Edinburgh, which I give as follows—

System.	Capital Cost.	Interest and Sinking Fund Charges per Annum.	Interest and Sinking Fund Charges per Car-mile.
	£	£	d.
Cost of new electric undertaking	1,677,600	109,127	4·547
Cost of converting cable system	695,700	56,014	2·334
Cost of providing a similar number of omnibuses	456,640	64,131	2·672
Cost of providing omnibuses to give the same seating capacity ...	729,900	103,155	2·886

I may say in the first instance that in considering the question of the form of traction to be adopted in Edinburgh, it is necessary to keep in mind that there are very considerable assets in the cable system which are convertible to electric traction, so that the problem in Edinburgh is not substantially different from those electric undertakings which have in the near future to face extensive renewals of their permanent way. Therefore, on this account, we do not have to face the question of an entirely new electric undertaking. If electrification is carried out, the cost will be as indicated in the table, viz., £695,700 for conversion. However, the figures which I give for an entirely new system are interesting in considering the question of capital expenditure, and the influence it will have in the future on entirely new systems or new routes. From these figures you will notice that the cost of a new system would work out at 4·547d. per mile as against 2·672d. per omnibus mile for a similar number of omnibuses—the mileage being the same in each case—viz., 5,750,520. In these figures similar amounts are provided for plant and buildings. It will be seen that the omnibus has a considerable advantage in capital expenditure over the figures for a complete new electric system, even providing for the same total seating capacity. On the other hand, of course, it is generally admitted that the working expenses of the omnibus are higher than the electric car.

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Although the total cost of operating motor omnibuses per mile may be higher than it is with electric traction for a city such as Edinburgh, it must be kept in mind that the capital costs per omnibus-mile remain at a constant figure in relation to the number of omnibuses in operation, whereas with electric traction the capital costs per car-mile increase in direct ratio to the decrease in the volume of traffic to be carried, or, the smaller the mileage run, the higher the capital costs per mile, and inversely the greater the car mileage, the less the capital costs per mile. When suburban routes are considered, or routes which have not a heavy traffic, the cost of capital expenditure for electric cars becomes prohibitive. It is in these circumstances that the motor omnibus will become the cheaper vehicle to operate. The total cost of capital expenditure depends upon the frequency of the omnibus service. The omnibus may be made to pay where the service is infrequent, the only condition being that the vehicle will require to be fairly well filled with passengers.

Future extensions and new routes will probably take the form of motor omnibuses, or other vehicles not dependent on a costly permanent way. New transport will be provided and faster vehicles will be used and development will be quick. I have seen in some districts motor omnibuses running along tramway routes, practically in competition with the tramways and worked by the same operating authority. I do not think this is going to help either the tramway or the motor omnibus. The omnibus should be used where the tramway cannot be used, and the one vehicle made supplementary to the other; I do not think that they need be competitive.

It may be of interest to the conference to know that, in Edinburgh, the intention is to run all the extensions with omnibuses, and at the present time we are closing down four cable routes which have not a great volume of traffic, being under £270 per week per mile of route. The tramway rails are worn out, and it would not pay to renew the permanent way at present prices. Instead of spending new capital on a tramway where the traffic is not sufficiently heavy to pay the high capital charges motor omnibuses are to be run. Only the future can tell at what point it will pay to lay tramway rails.

In conclusion, I would venture to say that I look with optimism to the future when, I believe, that the transport undertakings throughout the country will regain their financial stability and fulfil the high hopes which have been entertained by all those connected with the industry, and that they will continue to be one of the most efficient industries in the country.

DISCUSSION.

Alderman Fenton (vice-chairman, Sheffield Tramways Committee).—In the last paragraph but one the paper says "The tramway rails are worn out and it would not pay to renew the permanent way at present prices." What I would like to ask is whether he is going to leave the old rails in and run the risk of accidents to vehicles and of people being thrown off and perhaps killed. We have had experience of that ourselves, and you run the risk of big financial claims being made upon the Corporation for compensation in cases such as I have indicated.

Mr. H. Webber (general manager, Keighley Corporation Tramways).—I should like to ask Mr. Pilcher whether he has taken into account the fact that you usually get a longer period for the repayment of capital expenditure for tramways as compared with motor omnibuses, either electric or petrol.

Mr. J. M. McElroy (general manager, Manchester Corporation Tramways).—In that part of the paper where Mr. Pilcher gives the interest and sinking fund charges, he shows that the cost of a new electric tramway undertaking would be £109,127 in interest and sinking fund charges per annum, and that this works out to 4·547d. per mile, and by way of comparison he shows that the cost of providing omnibuses to give the same seating capacity would be £103,155 for interest and sinking fund charges, which works out to 2·886d. per mile. A wrong inference may be drawn from these figures unless explanation is given. He is providing omnibuses to give the same seating capacity, but, of course, if he is going to have double the number of omnibuses, he will have double the working expenses, and, whilst we are looking merely at the capital charges, we must not forget that this matter must be considered as a whole. You are going to get low capital charges, but that is not what we are entirely aiming at. We are aiming at getting low total costs. Mr. Pilcher, in giving us the low capital costs of omnibuses, is only looking at a small part of the real problem.

Alderman Palin (Bradford Tramways Committee).—I am afraid we cannot go into the motor omnibus question, because I believe the concensus of opinion in this conference would be against them—(a Voice: "Why?")—but we are greatly indebted to Mr. Pilcher for calling attention to the extreme importance of capital expenditure. We have incurred it recklessly in the past with regard to road widenings, which never ought to have been charged against the tramway undertaking. That is a direction in which we might exercise a little more care in future to our benefit. It is not only municipal concerns, but also private concerns, who have set the pace in this connection. The only charge on capital account for street work should be that which has a direct bearing or makes a direct contribution to the working of the tramway undertaking. If you are providing a terminal station in a public square, naturally that ought to be charged to the undertaking, but if the road is too narrow for a tramway it is too narrow for any other kind of traffic, and there ought not to be a tramway, or the cost of making the roads wide enough to take the tramway and the other traffic ought to be put upon the proper authority, namely, the Highways Department, and not the Tramways Department. Then we might have regard to the fact that we have competitors with municipal tramways, and it is a very strange thing to me that we go to our competitors and buy our material, and we ignore the possibilities which are open to us. In some cases we have incurred considerable capital expenditure in car works, and despite the fact that we have these works, and that they are in most cases giving good results, we do not use them in the manner we should. We go to the people we compete with to buy our cars and motors, etc., whereas some of the work we are capable of doing ourselves, and of meeting our own requirements. Moreover, by going to our competitors, we very often waste capital by purchasing an inferior article. There is a danger at the present time of a shortage of cars, and our experience with one firm, who sold thousands of cars in this country in the early days of the tramway industry, was that we had to rebuild them and incur capital expenditure, and we are in danger of doing that to-day by purchasing from the same shop. If we get an inferior article we have only ourselves to blame, but at any rate if we consider the mistakes we have made on capital expenditure in the past the paper will have been of some service to us.

Mr. R. H. Wilkinson (general manager, Bradford Corporation Tramways).—There is one item Mr. Pilcher has given in his paper which interests me, namely, that because the revenue on some routes does not exceed £270 per route mile per week he proposes to close them down and operate them with motor omnibuses. I consider that figure is a very high one. In Bradford we have over 50 route miles of tramways, with an average income of £198 per route mile per week. I would also like to call attention to one other item. In the fifth paragraph from the end the paper says, "On the other hand, of course, it is generally admitted that the working expenses of the omnibus are higher than the electric car." I would like to confirm what I have said before, and to call attention to the fact that it is generally admitted that, with the railless vehicles, the working expenses are always less than the expenses of the tramcar, and I should very much like to know why Mr. Pilcher prefers the motor omnibus to the railless omnibus. I have been going very closely into the question of railless vehicles, and, as I told you in June, at Birmingham, I am constructing a railless vehicle capable of seating over 50 people, and that vehicle would have been on the road in June but for the difficulty in getting material from the steel makers. I believe such a vehicle will be the means of saving vast sums of money which would otherwise be spent for renewals. Whilst the war was on there was difficulty in obtaining steel, but it is even more difficult to-day. The delay in obtaining deliveries of steel has prevented the completion of this vehicle, but I feel confident that such a vehicle will result in a considerable saving.

Mr. E. S. Rayner (general manager, Hull Corporation Tramways).—There is one point in connection with this paper, and that is I do not think the figures on page 5, showing the interest and sinking fund charges, give a right impression. I do not think it is quite fair to give a bald comparison without stating the car-miles per mile of track, because undoubtedly that is the governing feature. Where you have a certain car mileage per mile of track the interest and sinking fund charges may be 4·547d., as stated in the paper, but obviously if you increase the density of your traffic along that line of track, your interest and sinking fund charges may be one-half or even less, and therefore in considering capital charges in the abstract, without considering the traffic to be carried, it does not convey very much and is apt to be misleading. (Hear, hear.) With regard to running costs, of course, these do not come into the paper, but in considering any scheme you must of necessity consider your running charges; in other words, your revenue account and your capital expenditure and the interest payable on that capital must come into consideration in arriving at your total cost. With regard to the question of omnibuses, I think that the most unsatisfactory feature in connection with petrol omnibuses, apart from capital expenditure—which, perhaps, is their best point—is that we all realise that their operating costs are high, and in addition to that there is the essential feature of fuel. The cost of fuel, as we have seen by the last and sudden increase in the price of petrol, is absolutely unstable, and we do not know where we shall be in the near future with regard to the price of fuel, which is essential to the omnibus; and therefore it appears to me that in carrying out extensions it is advisable to utilise that form of traction where the cost of motive power is least liable to big fluctuations, and can be

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obtained at a comparative stable figure. In that respect you have to consider electricity, because obviously an increase of 50 per cent. in the cost of petrol affects traction by motor omnibus to a very much greater extent than an increase of 50 per cent. in the cost of coal would affect the price of electricity. Consequently, we cannot, although these figures of capital charges are interesting in the abstract, consider capital charges apart from running charges, and I consider that, in looking at your running charges, you must have some reliable source of power, and in deciding on that source of power I think that electricity is far more likely to remain at a constant figure than petrol. In that respect I should like to say I am very much in agreement with Mr. Wilkinson with regard to the railless vehicle; where you are only using one unit per car-mile for the trackless vehicle, which at our power costs to-day amount to 1·15d. to 2d. per omnibus mile, an increase of 100 per cent. in the cost of coal would only mean an increase in the cost of electricity of at most 1d. per car-mile, whereas the same increase in the cost of petrol might affect you to the extent of 4d. or 5d. per mile.

Mr. C. Furness (Blackpool).—It would be interesting if Mr. Pilcher could supplement the table on page 5 by informing us of the loan period which is permitted for omnibuses as compared with the loan period for tramcars. I think it is common experience that you have double the loan period for tramcars that you get for omnibuses. (A Voice, "Three times.") I thought I would put it on a conservative basis, and it would be very valuable for reference in the proceedings of this conference if Mr. Pilcher could supplement what he has given by showing the financial balance and the operating expenses for 10, 15, and 20 years hence on the capital expenditure shown in this table. Then the members would have a better idea as to the value of the financial figures shown in the fourth column.

Mr. J. B. Hamilton (Leeds).—I am quite sure that such an experienced traction man as Mr. Pilcher never intended that this conference should accept the figures which he has given with regard to the capital expenditure as being the conclusion as to the matters which should be considered when one is deciding as between omnibuses and electric cars. I think the terms of his paper induce one to believe that he was dealing alone with capital expenditure, but I quite agree with other speakers that, unless some figures of the total working as well as capital costs are given, inferences may be drawn which are quite erroneous. I am interested more particularly in what Mr. Pilcher has dealt with in a single sentence, viz., with regard to other forms of traction. It occurs to me that perhaps in the consideration of this matter he has rather limited his vision. He certainly did not refer to that form of railless electric traction which Mr. Wilkinson has referred to, and which, if a larger vehicle can be provided, has all the elements of very great success. It certainly avoids expensive rail construction, and I believe, from its certainty of operation and cost, it bears a very favourable comparison with the petrol vehicle, and in future will, I think, in many cases enable those extensions to tramways to be made which many authorities are being asked to consider. I think there is still another form of construction which, perhaps, ought to be brought before the members here, and that is the form of open construction which avoids the costly sub-foundation of concrete and the paving of the streets. I quite agree that in the centre of a town it is usually not a practicable proposition, but when you are going to lay a track over private right of way, as is possible in many places in the country, the expense of renewing is very much reduced, and with a little foresight on the part of the authorities concerned, widenings of roads to permit of this can be provided for. There is no better example of this than what has been done in Liverpool. I think it will be possible to put down this form of construction, which will provide rail transport, with all its many advantages and high speeds, at a saving of more than 30 per cent. of the cost of ordinary tramway construction. I am reminded also that this would allow of a great increase in speed, an average of at least 20 miles an hour, as against 7, 8 or 10 miles an hour which is the factor of safety in ordinary highway operation. There is also, of course, the lessened maintenance costs. I believe I see a very great future for this form of traction. The dominant cry at the present time is speed; speed in all forms of conveyance. It is all very well to talk of living in a purer atmosphere and taking your workpeople out into it. The worker, I believe, will pay the fare, as I have already indicated, but what the worker really grudges is the time. If you want a workman to travel between his home and his work, how much time do you think he can spend per day on the journey? This is particularly important if you want him, as I think in many cases is so, to go home to dinner. Therefore I say deliberately that, if the time which he has to travel on the journey exceeds 12 to 15 minutes at the very outside it becomes an impracticable proposition for the workman to travel more than twice a day. In fact, we have been making a lot of observations as far as Leeds is concerned, and that is the opinion we have come to, so that in the new form of construction, which I think Mr. Pilcher will agree he has overlooked, you get first of all a low capital expenditure, you get low working costs, and you get also that thing which I believe to be the great essential to a successful transport scheme, namely, speed. I believe, with that form of construction, we shall attain the objects which we have before us, of not spending unnecessary sums, or, rather, reducing our capital expenditure to the lowest possible figure.

The President.—I now call upon Mr. Pilcher to reply.

Mr. Pilcher.—One of the gentlemen from Bradford, I think, said that he was not very clear why we should run omnibuses if we could run cars, but there are some routes, and we have some in Edinburgh, where cars would be quite impossible, and on those routes we run omnibuses successfully, i.e., we are providing transport which has never hitherto been provided, except in the times of the Sedan chair, running between the Castle and the Palace in Edinburgh, and it is quite impossible to put any other form of traction down there. We are running omnibuses, and we are running them very profitably at a high rate of operation, but still on a paying basis. Mr. Wilkinson mentioned railless traction, and Mr. Hamilton also referred to another form of traction. There are very few keen advocates of railless traction, and it does not appear to have made the progress we expected of it ten years ago. Why is it not taking on? We hear of isolated cases, but no one seems to take on with it, generally speaking, and my reason for not being a very keen advocate of it is that it has to have wires erected, and it is not so mobile as the omnibus. I think the motor omnibus has a very great advantage in its mobility, which has a financial relation to the vehicle. It is worth money; it is worth several pence per mile to have a mobile vehicle which you can move from one part to another and form cross-routes and make inter-connections between one part of the city and another. I do not think there is a town in this kingdom with an electric system that has not scope for an omnibus service. There are always junctions which are difficult to arrange for with electric traction, whereas the omnibus will fit in and pay. I think some of us are a little afraid of the omnibus, and frightened to speak in favour of it. Personally, I am strongly in favour of electric traction for through routes, but for subsidiary routes, and routes where there is not very great traffic, the omnibus is going to be the vehicle of the future. Therefore with all due deference to Mr. Wilkinson, unless there is some new development—and we hope it will develop—in the direction of increasing the seating capacity, I do not think the railless vehicle will beat the motor omnibus. At the same time I hope we shall get some enlightenment in that direction, and I am sure we are always looking for it. Alderman Fenton mentioned the removal of rails. That is a very serious question. Personally, I do not know that we are going in for omnibuses permanently. We live in hopes that electric traction will be put down, and then the concrete foundations will come in, the existing rails will be left, and the slots filled up so that there is no nuisance. In connection with Alderman Fenton's remarks this morning regarding permanent way, it is rather a remarkable point that in Edinburgh, when the question of removing the cable tramways from the streets was discussed, it involved the discontinuance of the upkeep of the permanent way by the tramway authority, and the road authorities became very acutely concerned as to who was going to keep up the streets. (Laughter.) With regard to Mr. Furness' point concerning interest and sinking fund, the tramway figures were based on thirty years life, as an average for the whole undertaking, and the omnibuses on eight years. My figures in connection with the table, which Mr. McElroy and Mr. Hamilton referred to, might lead to a certain misapprehension. Naturally, if you have to run an omnibus with a smaller seating capacity, such as we have in mind—a 32-seater, compared with a 52-seater car—there is a serious reduction in the seating capacity, and it will be necessary to increase the costs to that extent, which would be about 60 per cent. in the case of Edinburgh, but the mileage was increased, and that is how we get such a favourable figure. It is quite true that we have a very large increase of working expenses. We were, however, arranging for a re-routing of the system, which would, we think, very largely pay its way. It is not quite fair to put a figure like that to a conference, but I can give you a figure, worked out on an equitable basis, for the Edinburgh system, i.e., the basis of 2·6d. per mile, worked out per passenger per seat, would be 3·4d. as against 4·5d. for new electric traction. That is on exactly the same seating capacity, but my point is that even there, according to the high cost of present construction, the electric car is at a great disadvantage, as far as capital expenditure is concerned, and my only object in writing these notes this morning was to call the attention of the conference to this question, because I feel myself undertakings will have to face it in the future, and it will mean that, whereas many undertakings were prepared to lay rails in the past on pre-war figures, they will not be able in the future to lay rails until a much later period, until the traffic has developed to such an extent as will warrant them laying down the rails. It is quite true you cannot discuss one subject without the other; the capital is inseparable from

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working expenses, but I was asked to make a few notes on capital expenditure, and I have endeavoured to do so. It would be wrong if any misinterpretation of this paper was taken on these lines, but even as working expenses are inseparable from capital, so sinking fund and interest are inseparable from capital, and they are all inter-related one to the other, but if I have done anything this morning to call attention to the importance of this question I shall be very happy.

The President.—I would like to move a hearty vote of thanks to Mr. Pilcher for his very interesting paper, upon which we have had such a very useful discussion on this question of the tramcar *versus* the motor omnibus, which I am sure many of us would like to have heard more about. That will, perhaps, be a subject for discussion at another meeting.

The vote of thanks was carried with acclamation, and an adjournment was made to the Royal Hotel, where the annual luncheon of the Association was held.

ANNUAL GENERAL MEETING.

The annual general meeting was held on Thursday afternoon, September 16, the President, Sir John Courtis, Kt., in the chair.

On the suggestion of **the President** the minutes, which had been circulated to all the members, were taken as read.

On the motion of **Alderman Bowes** (Manchester), seconded by **Councillor Stanbury,** the report of the Executive Council, which had also been circulated among the members, was taken as read.

The report and statement of accounts of the honorary treasurer were then adopted without discussion.

ELECTION OF OFFICERS.

NEW PRESIDENT.

The President.—It is my privilege, as the outgoing president of the Association, to move the election of the incoming president, and it is a privilege which I am glad to have, to propose to you the name of our vice-president, Mr. Holford. He has been a member of the Executive Council for a number of years, and for a certain number of years he undertook the duties of honorary secretary during a very busy time. I can assure you that he has done much useful work on the Executive Council, and the services which he has rendered are very highly appreciated. I have, therefore, the greatest pleasure in proposing that Mr. Holford be president of the Association for the ensuing year.

Mr. G. W. Holford,
President of the Municipal Tramways Association, 1920-21.

Mr. T. B. Goodyer (Croydon).—As a past president, I have much pleasure in seconding the proposal that Mr. Holford shall be our president for the coming year. It was my privilege during my presidency to have Mr. Holford as our very able honorary secretary, and I support most heartily all the good things the president has said with regard to him, because I am sure he will make a very worthy successor to those who have preceded him.

There was no other nomination, and Mr. Holford was unanimously elected.

Mr. G. W. Holford (general manager, Salford Corporation Tramways).—Mr. President, Mr. Goodyer, and gentlemen, I very much appreciate this great honour which you have conferred upon me in electing me to be president of the Association for the ensuing year. I cannot claim to have been a member since the inception, but I think I have been a member for about 15 years. I know the good work the Association has done, and I feel confident that most of the undertakings would not even be in the position that they are in to-day—they would, indeed, be in a much worse position—if it had not been for the help of the Association. (Hear, hear.) If we had all gone struggling along, each in our little way, we should have had to pay penalties which, fortunately, we are not paying to-day,

Alderman Richard Mayne (Sheriff of Newcastle),
Vice-President of the Municipal Tramways Association 1920-21.

and I think the success of municipal tramway undertakings generally depends very much on the co-operation of all of us working in one direction. Any work which I can do for the Association is a pleasure, and during my term of office I shall do my very utmost to serve the interests of the Association. I hope that we may have the pleasure of greeting you in our own borough of Salford at some later date, and we shall do our best to entertain you as well, I will not say better than, but equally as well as those Corporations who have entertained you in the past have done. I am pleased to see that, looking through the list of presidents, with the exception of one, they are all living to-day, although the Association is something like 20 years old. We have had the pleasure of the company of a number of them at this meeting, and I hope we shall see them at many more of our meetings. I can only thank you for electing me to the office of president.

VICE-PRESIDENT.

Mr. G. W. Holford.—It is my pleasure and duty to propose the vice-president for the ensuing year, and I submit the name of Alderman Mayne, sheriff of Newcastle, who was a member of the Executive Council for a number of years, and who at the present time, I think, is the oldest lay member of the Council. Alderman Mayne has always shown very deep interest in municipal tramway work, and I have every confidence that, if he is elected, your interests will be well served. I have very much pleasure in proposing Alderman Mayne as vice-president for the ensuing year.

Councillor Turner (Belfast).—I beg to second that proposal.

The motion was put to the meeting and carried unanimously.

Alderman Mayne.—When I arrived in Cardiff a night or two ago I little thought that I would leave it as vice-president of this Association. I shall certainly try to prove in the future the real interest I do take in the welfare of the Association.

OTHER OFFICERS.

Mr. A. R. Fearnley was then re-elected honorary treasurer, and Mr. R. M. Heath, deputy town clerk of Manchester, was elected honorary solicitor in succession to Mr. E. R. Pickmere, town clerk of Liverpool, who had resigned.

As a result of ballots to fill vacancies on the Council, the following were elected—Mr. J. M. McElroy (Manchester), Mr. Alfred Baker (Birmingham), and Mr. Henry Mozley (Burnley), Councillor Higham (Blackburn) and Councillor Sellars (Huddersfield).

HONORARY MEMBER.

The President.—I want to propose the election, as an honorary member of the Association, of Mr. Peter Fisher, late general manager Dundee Corporation Tramways, whom, you have been informed, has resigned. Mr. Fisher, as many of you know, is one of the original members of the Association, one of the founders of the

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Association, and we feel, as an Executive Council, that it is an honour that we should do Mr. Fisher in return for the services which he has rendered to this Association during the last 20 years. Many of you know how valuable these services have been, and it was a matter of great regret to us that Mr. Fisher was obliged to resign his membership. We should, I am sure, like to have him identified with the Association still, and this is the only way in which it can be done. I propose that he be one of the honorary members of the Association.

Alderman Squires (London County Council).—I should like to have the pleasure of seconding that proposal. I have found Mr. Fisher, not only when I was in the north, but when he came to London, a most efficient man, and one most anxious to do his duty, and I think we shall be wise to-day if we appoint him to what I regard as the position he has earned.

The motion was carried with acclamation.

VOTES OF THANKS.

The President.—If there is no other business, Councillor Horrocks has a resolution to propose.

Councillor Horrocks then proposed—"That the heartiest thanks of this Association be accorded to Sir John Courtis for his presidential services during the year." Personally, I have not had a great acquaintance with Sir John Courtis, but the general manager of the undertaking with which I am connected, during the last 12 months, has had considerable experience of the work of the Executive Council, over which Sir John Courtis presided, and through him I have learned of the excellent services that he has rendered to the tramway industry of this country. The frequency with which we have been called together during the last 12 months I am sure will convince you that there has been a great amount of work done, and it must have made a great call on Sir John's time, and I think for that we ought to be extremely grateful. Moreover, since we have been here in this city of Cardiff we have heard his services eulogised by his own townspeople and the people of his own city, and that, I think, is the strongest recommendation that a man can have. It is, therefore, with the greatest possible pleasure that I move this resolution.

The Mayor of West Ham having seconded the resolution, it was carried with acclamation.

When the president had replied, **Alderman Priestley** (Bradford) moved the resolution—"That this conference places on record its high appreciation of the services rendered by the members of the Executive Council during the year." **Alderman Dan Irvine, M.P.,** (Burnley) seconded, and the motion was carried unanimously.

The resolution—"That the warmest thanks of the Association be given to the representatives of this Association upon the National Joint Industrial Council for the tramways industry, for their devotion to the interests of the tramway industry during the year, and we desire to recognise to the full the great sacrifices which have been made by them during the first year of the National Council"—was proposed by **Alderman Walkden** (Mayor of Wigan), seconded by **Councillor Sellers** (Huddersfield), and carried unanimously.

The resolution—"That this Association begs to tender to the Lord Mayor and Town Council of the City of Cardiff their best thanks for the cordial reception and generous hospitality extended to them during their stay in this city and for the excellent facilities afforded to the delegates and their friends, and we also tender to Mr. Horsfield, the general manager, and his assistants, our warmest appreciation of their efforts to make the conference the success that it has been"—was proposed by **Alderman Linsley** (Salford), seconded by **Councillor J. Timpson** (Mayor of Portsmouth), and carried with acclamation. The president acknowledged the vote of thanks in the absence of the Lord Mayor, and Mr. R. L. Horsfield also expressed his appreciation and that of the other officials of the Corporation Tramways Department.

LUNCHEON IN THE CITY HALL.

At the conclusion of Wednesday morning's session the members of the conference were entertained at luncheon in the City Hall by the chairman (Alderman Sir John W. Courtis) and the members of the Tramways Committee.

The toast of "The King" was proposed by the president (Alderman Sir John Courtis, Kt.), and duly honoured.

The Right Honourable the Lord Mayor of Cardiff (Councillor G. F. Forsdike, J.P.) proposed "The Municipal Tramways Association." He said—One of the penalties which falls upon anyone holding the high civic office that I do, a penalty, by the way, which is none the less because you have to share it with me, is that he has to use his tongue very often, and since I have sat at this luncheon I have wished, indeed, that I had the tongue of your president, which is a long one—(laughter)—or even the shorter tongue of your secretary. (Loud laughter.) I do not know whether people in the southern part of England are stronger than we are in Wales, but my friend, the Mayor of Portsmouth, tells me that yesterday his colleagues re-elected him for the third time. (Hear, hear.) That would be an impossible task in the city of Cardiff, because at the end of the second year he would either be in the grave or in Colney Hatch. (Laughter.) But I want to express to you, sir, my sincere desire that the distinguished public service you have rendered to the people of Portsmouth may be continued, because it is a great honour that your fellow citizens should have placed you in that high office three years in succession. I am not at all sure myself, gentlemen, that the public is sufficiently appreciative of the work which local authorities do. (Hear, hear.) I have heard in my own city the work of the Cardiff City Council characterised as "the parish pump." (Laughter.) The criticism we receive is often very unkind, and more often untrue—(hear, hear)—and it does say much for us, I mean for the nation, that, despite that criticism—and it generally comes from the class of man who would not dream of trying to come in himself, either because he has not the capacity or some other reason—(laughter)—in all the cities and smaller districts in our country there are public-spirited men still willing to carry on the work; and, although there are many more kicks than halfpennies about this, it is a very proud boast in this country that voluntary work for national purposes, such as the work we are engaged in, is done so cheerfully and so well. (Applause.) I have, Mr. President, to propose the toast of "The Municipal Tramways Association," and I have already extended to those who are attending the conference a civic welcome on behalf of my colleagues in the Council. I would like to add this to that statement, that you are at present sitting in a building which, we are told in Cardiff, is second to none in the whole kingdom—(hear, hear)—and that building is placed in a park which, for attractive features and its proximity to the centre of the town, is not equalled anywhere in the kingdom; and that, gentlemen, is a tribute which we in the Cardiff City Council are always ready and willing to pay to the far-sighted policy of those who occupied these seats before us. We are very proud of this park and the wonderful buildings which have been erected upon it; and when I tell you that those interested in architecture come to Cardiff from all parts of the world to see our buildings and take away, if they can, ideas from our buildings which they may be able to utilise in their own districts, you will appreciate that I do not place the beauty of our buildings too high. Only last week a gentleman from China visited us. He had come specially from London, having heard about the glorious municipal buildings and the other public buildings in the Cathays Park. This is all due, as I say, to foresight on the part of our predecessors in office; and I do think that any carping critic has only to look around this city of Cardiff to satisfy himself that his criticism is very often unjust, and that if he would only recognise, as he ought to do, and as all ratepayers should do, that within limitations, because we cannot all be full of brains, local authorities are conducting the government of this country exceedingly well under very trying conditions. (Loud applause.) I am glad, gentlemen, to have the honour of proposing this toast, and I am glad to learn that, seated on my right but one, is Mr. Young, who was the first president of the Association in its first year—(loud applause)—and who is still well and taking an active interest in the work of the Association. He was, nineteen years ago, I am informed, the general manager of the Glasgow tramways system—that system which is the pontifical throne for all of us, because from Glasgow radiated the aims and ideas which we in other parts of the country have been carrying out. I am very pleased indeed to have made Mr. Young's acquaintance, and to have heard of his wonderful record of the past. I myself, and some of my colleagues, are not so familiar with the work of the Municipal Tramways Association, but we shall understand from the work of the conference in Cardiff the very real work which the Association carries out, and which reacts, favourably or unfavourably, as you carry out your duties, upon all municipal authorities owning tramway undertakings. I have had great pleasure, as I said this morning, in going through the agenda for last year, and I find that such matters as rating, taxation, standardisation of materials, the questions of hours of labour and conditions of service, and a host of other questions which touch other undertakings have been dealt with and are being dealt with by this body. It may be said that an association of this kind is unnecessary, because Governments must recognise, and would recognise, that there must be special treatment allocated to municipal authorities owning undertakings like these. Don't you believe it, colleagues! (Laughter.) If the Government can kick at municipally-owned tramway undertakings the Government is out to do it. (Hear, hear.) No special consideration is shown to those of us who are carrying on public services mainly for the benefit of our own area, but generally speaking for the interest of the whole country. There is no special consideration given, and all the pressure which can be brought to bear on Government departments or the various departments which are affected is necessary, in order to see that the municipally-owned tramway undertakings get reasonably fair treatment. These are some of the objects which the Association

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is carrying out, and carrying out, as far as my limited knowledge permits me to understand, exceedingly well. I find that you have, through your secretary or your Council, attacked one or two of the Government departments, not particularly successfully up to now, perhaps, but one is full of hope that all the points that you are putting forward with regard to various matters will receive better consideration, particularly on the point of taxation—(hear, hear)—depreciation, and matters of that kind which are so vital to us in the future. Gentlemen, you have come to Cardiff at a time, fortunately for us, of immediate industrial peace. But I want to say this to you before I submit the toast, that although I personally feel confident that we are not going to have this big industrial catastrophe which is threatening, should it come to pass the local authorities are going to have placed upon them a very heavy burden in addition to those which we are already carrying, for it will be the duty—and it will be a duty, I am sure, which will be carried out to the hilt—of all of us to see that our own local services are maintained. (Hear, hear.) Without discussing for a moment the merits or demerits of the miners' question—we are not here to do that—we can say this, indeed, I can only repeat what Mr. J. H. Thomas himself said, that their claim is a challenge to the constitution, and, it being a challenge to the constitution, if it should happen that in cities like Cardiff, Hull, Newcastle, and those various large centres, the local services are threatened with stoppage, our light and our power, our gas and our water, it will be our duty, as local authorities, to look after and make arrangements for the carrying on of them—(loud applause)—and in doing that we shall not be in any sense at all raising an antagonistic hand to the miners or the claim, but we shall be fulfilling the duty for which we were placed in office—(hear, hear)—namely, to see that the public are properly and, as far as we can, adequately served. (Applause.) Mr. President, it is with the very greatest pleasure indeed that I submit to you the toast of " The Municipal Tramways Association," believing, as I do, that they are carrying on a good and a necessary work, and a work that is beneficial to the whole community. I give you a blessing as far as I am able to do, and, as I said this morning, I sincerely hope that you will look back upon your Cardiff conference, apart from the pleasure of your visit, as marking a distinct step forward in the work of your Association. With these words may I ask you to drink with great heartiness the toast of " The Municipal Tramways Association," coupled with the name of Sir John Courtis.

Sir John Courtis, replying to the toast, said—My Lord Mayor and gentlemen, the time has arrived when we should be back again conferring, but I feel that my colleagues, the members of the Association, would not allow me to go away without expressing to you their thanks for the kind way in which you have proposed the toast of the Association—(hear, hear)—and the very nice things you have said about it, with all of which I agree, because I do know the very serious and very important work and duties which are carried out by the Association. During one's presidency one sees a great deal more than one does when one is a mere member of a committee or an ordinary member of the Association. The work is very heavy and very important, and although, as you say, we have not met with very much success in our efforts with Government departments, I can assure you that we have at least convinced a certain department of the Government that we are very much alive to the matters that they bring forward which affect us as an industry in the operation of tramways. I need not refer to them now, but I will tell you privately when we have more time what we have done, because, if I publish it, perhaps it may get abroad and our efforts may be nipped in the bud. (Laughter.) I am sure, my Lord Mayor, the members of the Association appreciate very much the warmth of the welcome you have given them to our city of Cardiff. You referred to the fact that some of your predecessors have been responsible for the purchase of the Cathays Park and the placing of all these public buildings in this Park. I am one of the old members of the Corporation—I think I am not the oldest member of the Corporation present—but I am one of those who were wicked enough to vote and support the Mayor when the Bill came before Parliament for the acquisition of this Park. We had some opposition at our public meeting, and we had no end of criticism in the Press about what spendthrifts we were, building palaces here, and what use could they be, and all that sort of thing. You know, my Lord Mayor, the history of the thing. We were very much criticised, and really we walked through the streets feeling we ought to be ashamed of ourselves for having voted such sums of money to acquire this splendid Park. We have now lived all that down, and we have lived to see the day that we have been blessed for our foresight, as the Lord Mayor said, in acquiring the Park and having these buildings erected. Now we have people from all parts of the world to see them, and we receive very favourable encomiums upon our foresight and progress. I think that this Park and its public buildings is one of the finest assets Cardiff has, and I may tell you that the Cardiff Corporation members are very much alive to its future. Cardiff is not going to stop where it is to-day. It is going to advance very rapidly. My Lord Mayor, let me say how very much we appreciate the very kind way in which you have received us as an Association, and we look forward to having the pleasure of seeing you and your company at our official luncheon to-morrow, when we shall have something further to say.

The Sheriff of Belfast (Councillor Turner) proposed " The Chairman and Members of the Tramways Committee of the City of Cardiff."

Alderman Morgan Thomas, responding to the toast, said—I did not expect to have my name associated with the toast which has just been proposed by the High Sheriff of Belfast, but I am very pleased to be able to bear testimony to the work done by my colleagues in connection with the tramway system of Cardiff. We are very fortunate in having a chairman of that committee for years past who has exercised exceptional ability in developing the system of tramways in Cardiff. I am referring to Sir John Courtis. I had the honour of being with him over twenty years ago as one of the pioneers in developing Cathays Park, and I feel very proud to-day, with him, that what was done then is appreciated to-day by those who visit our city. With reference to the work of the Tramways Committee, and of all tramways committees in the country for that matter, we are passing through very critical times, times when it is necessary to exercise tact and patience, but at the same time to have due regard to the interests of the public ; and I want to bear tribute here to the fact that, although Sir John and I sometimes have differences—they are very minor differences—I want to bear tribute to the great work he has done under very trying circumstances on behalf of this city. Whatever may be the criticism of people outside, and, as the Lord Mayor said, very often these people have very little knowledge of what really has been done and is being done on behalf of the public, I want to say that we feel extremely proud that you have appointed him president of your Association this year, which, I think, shows after all that you have recognised in him the public spirit and ability which he has displayed here for years past. I want to thank you for the very courteous way in which you have received this toast.

The proceedings then terminated, and the business of the conference was resumed at 2-30 p.m.

THE ASSOCIATION LUNCHEON.

The annual luncheon of the Association was held at the Royal Hotel on the adjournment of the Thursday morning's session, the President (Sir John Courtis) being in the chair. After the loyal toasts had been honoured, **Mr. G. W. Holford** (vice-president), in proposing " The Cardiff Corporation Tramways Committee," said they would all regret it if they left Cardiff without tendering to the Cardiff Tramways Committee their hearty thanks for the opportunity of seeing their interesting city and for their hospitality.

Alderman R. J. Smith, in responding on behalf of the Tramways Committee, said he would like to tell the members how very pleased they were that the Association had elected their chairman, Sir John Courtis, as president. They were proud of it, and regarded it as a great compliment to their committee. In Cardiff they recognised the valuable services their president had rendered to the community. They were grateful to him for the faithful and diligent work he had done on behalf of the city, especially in connection with the tramways. Cardiff was a modern city, and had yet to attain its majority, but they were ambitious in the administration of the city. They were glad to have new ideas put before them by such organisations as the Municipal Tramways Association.

Alderman R. Mayne, chairman of the Newcastle Corporation Tramways Committee, proposed the toast of " The Visitors," and asked Mr. Albert N. Todd, president of the Public Ownership League of America, who was visiting this country on a tour of inquiry, to respond. He hoped he would enjoy his visit. They were glad to know that Americans were coming here in greater numbers to learn our methods, breathe our atmosphere, and absorb our spirits. (Laughter.)

Mr. Albert N. Todd, in responding, said he could not tell them how deeply he appreciated the honour they had conferred upon him in inviting him to be present that day. If there was any reason why he felt he should accept the invitation, it was that for many years he had had a deep-seated love for civic progress. It was because he knew of the splendid municipal work that had been done in this country that he had come here on a visit of inquiry. He wished to learn how they in America could work out their civic problems with the same success. He found the highest ideals in public offices in this country, which not only promoted progress but made for good citizenship. America was a comparatively new country, and it was only within the last few years that municipal ownership had taken its place in their civic life. His visit here would send him back with renewed hope ; for he would take back with him valuable information and experience which he could place before the American people.

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ELECTRIFICATION OF RAILWAYS ADVISORY COMMITTEE
INTERIM REPORT.

STANDARDISATION PROPOSALS.

The following is the full text of the interim report which has been adopted unanimously by the Electrification of Railways Advisory Committee appointed by the Minister of Transport to inquire into railway electrification. Although dated July 12, the report was not issued until September 29.

INTERIM REPORT.

1. The Electrification of Railways Advisory Committee, appointed by the Minister of Transport, held its first meeting on March 22, and has held twenty-eight sittings.

2. The committee have had before them as witnesses representatives of the London and North-Western Railway, the South Western and Chatham Railway, the Metropolitan Railway, the London Electric Railways, the Lancashire and Yorkshire Railway, the North Eastern Railway, the London, Brighton and South Coast Railway, the Midland Railway, and the London and South Western Railway.

3. They have also had the advantage of receiving evidence from Mr. Ivan Ofverholm, the chief electrical engineer to the Swedish State Railways, and from Colonel Huber-Stockar, the consulting engineer to the Federal State Railways of Switzerland. The committee are much indebted to both of these gentlemen for the trouble which they took in coming to England and for the valuable information which they were good enough to place before them.

4. On the side of electrical contractors they have also had as witnesses representatives of the British Thomson-Houston Company, the English Electrical Company, and the Metropolitan Vickers Company, and have had a written communication from the Oerlikon Company, who were unable to send a representative.

5. The Committee sent out in April to all the chief railway companies a questionnaire relating to the matters covered by their terms of reference, and from the replies to this, together with those sent in to the questionnaire issued in January by the Ministry, as well as from the information given by the witnesses, full statistical tables have been prepared, and have been considered in detail by the committee.

6. The committee understand it is very desirable that decisions on certain general points covered by their reference should be arrived at as soon as possible; they have therefore confined their consideration in the first instance to points of this nature, and deal only with them in this interim report. Further matters, which there has not yet been sufficient time to examine, are left over for a subsequent report.

7. The terms of reference under which the Committee were appointed are as follows—

I.—Whether any regulations should be made for the purpose of ensuring that the future electrification of railways in this country is carried out to the best advantage in regard to interchange of electric locomotives and rolling stock, uniformity of equipment, and/or other matters.

II.—If any such regulations are desirable, what matters should be dealt with, and what regulations should be made.

III.—How far it is desirable, if at all, that railways or sections of railways already electrified should be altered so that they may form parts of a unified system.

In respect to Reference I.

8. The committee consider that, in order to ensure the future electrification of railways in this country being carried out to the best advantage in respect to the matters indicated in the reference, it is desirable that certain general regulations should be made for observance by the railway companies when electrifying their lines.

9. The committee consider that these regulations should be directed specially to ensuring standardisation of those methods and appliances which are likely to prove the most satisfactory under British conditions.

10. They consider, further, that such regulations should put no avoidable difficulties in the way of the adoption in future, with the approval of the Minister, of any improvements in methods or appliances which may from time to time become available with increasing knowledge and experience.

In respect to Reference II.

11. In view of the desirability of the railways which are now contemplating immediate electrification knowing as soon as possible the decision of the Minister on certain fundamental matters, they recommend that regulations should be issued in accordance with the following conditions—

(i.) That in the case of those railways which have not as yet electrified any lines, as well as those which at present have electrified all or part of their lines on a direct current system, their electrification, or extended electrification, as the case may be, should be carried out on the direct current system.

(ii.) That the standard pressure of the direct current system at the sub-station busbars shall be 1,500 volts, subject to—

(*a*) The continuance of any existing 600 volt and/or 1,200 volt installations, and subject to the approval of the Minister of their extension.

(*b*) The adoption of half the standard voltage—750 volts—in those cases where it can be shown to the satisfaction of the Minister that advantage would arise from the use of this lower pressure.

(*c*) The adoption of higher pressures—limited to a multiple of the standard pressure—where it can be shown to the satisfaction of the Minister that sufficient advantage would accrue.

(iii.) That both overhead and rail conductor collection should be permitted, as long as the position and general design of the conductors and structures are in accordance with recommendations which will be made in a subsequent report. In that report the committee will also suggest the regulations required to ensure that locomotives and/or motor coaches shall be able, whenever it may be necessary, to run at two different voltages, e.g., 600/750 and 1,500 v., and/or with either rail or overhead collection.

(iv.) That the generation of current for direct current lines should be alternating 3-phase at such voltage as may be desirable in each case.

(v.) That in the case of existing generating stations supplying at any frequency between 25 and 50 cycles it is unnecessary to make any change in frequency, but that it is desirable that where any one such frequency is in general use in a particular electricity district, any new power-station put down in that district for supplying a railway should adopt the frequency which has been approved by the Electricity Commissioners or is in general use in that district.

The committee desire to add on this matter that from the evidence which has been put before them, as well as their own experience, they have come to the conclusion that alternating current supplied to the sub-stations at a frequency of 50 cycles can be used for railway purposes without any detriment to railway working.

In respect to Reference III.

12. There is only one line of any importance in Great Britain which would not come under the terms of recommendation paragraph 11 (i.), above, namely, the electrified portion of the London, Brighton and South Coast railway system. The committee have considered with special care the very difficult questions introduced into the problem by the fact that this company long ago adopted a single-phase alternating current system for its suburban lines, and did so with a special view to the adoption of a system which at that time appeared the only one admitting of extension from London to Brighton when this extension became feasible. The general manager of the company (Sir William Forbes) has come before the committee to say that his company considers the extension to be now not only feasible but urgently desirable.

13. The committee is bound to recognise that if the railway is allowed to electrify its main line to Brighton on its present system, there will of necessity have to be a change of locomotives or multiple unit stock in any cases where other companies' trains run over that line, and that to this extent the wished-for general interchangeability will be interfered with. They recognise, on the other hand, that to change the existing suburban equipment of the Brighton railway to a direct current system would involve a large financial expenditure, which the railway itself could not be asked to undertake and which it would be difficult to justify to the public at the present time. It has further been stated to the committee that the electrification of the main line is in this case very closely connected with that of the suburban lines on account of the necessity, on economical grounds, of using the same rolling stock throughout.

14. Having all these considerations in mind, the committee recommend, as the course which on the whole has the balance of advantages—

(i.) That the electrical system of working at present in use, or actually under construction, on the Brighton company's suburban lines need not be changed.

(ii.) That in view of the recent proposals of the Government as to grouping of railway companies, the question of the system on which the L.B. & S. Coast Railway Company's proposed extensions

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to the coast should be carried out is now—in the event of the Government's proposals being approved by Parliament—one for special consideration from the point of view of the requirements of through working and interchangeability of traffic with the other systems forming part of the proposed Southern Group. Subject to these matters receiving the fullest consideration, and provided the completion of the proposed extension on the present system shows a substantial financial advantage, the committee are of opinion that it should be allowed.

The committee was constituted as follows—

Sir Alexander Kennedy, LL.D., F.R.S., Past President Inst.C.E., Past President I.Mech.E. (chairman).

Sir John A. F. Aspinall, Past President Inst.C.E., Past President I.Mech.E., consulting mechanical engineer, Ministry of Transport.

Mr. A. R. Cooper, M.Inst.C.E., M.Inst.T., engineer, Metropolitan District Railway and Tube Railways, representing the London Electric Railways.

Sir Philip Dawson, M.Inst.C.E., M.I.E.E., M.I.Mech.E., Messrs. Kincaid, Waller, Manville and Dawson, consulting engineers.

Sir Alexander Gibb, G.B.E., M.Inst.C.E., M.Inst.T., director-general of civil engineering, Ministry of Transport.

Mr. Charles H. Merz, M.Inst.C.E., M.I.E.E., Messrs. Merz and McLellan, consulting engineers.

Sir Philip Nash, K.C.M.G., C.B., M.Inst.C.E., M.Inst.M.E., M.Inst.T., director-general of traffic, Ministry of Transport.

Mr. Lightly Simpson, C.B.E., D.S.O., A.M.Inst.C.E., chief mechanical engineer, Ministry of Transport.

Mr. Roger T. Smith, B.Sc., President I.E.E., M.Inst.C.E., M.I.Mech.E., M.Inst.T., electrical engineer, Great Western Railway.

Sir John Snell, M.Inst.C.E., Past President I.E.E., M.I.Mech.E., chairman of the Electricity Commission.

Sir Henry Thornton, K.B.E., M.Inst.C.E., M.Inst.T., general manager and consulting engineer, Great Eastern Railway, representing the railway companies.

Mr. S. G. Redman, M.I.E.E., A.M.I.Mech.E., Secretary.

FINANCIAL REPORTS AND MEETINGS.

Shanghai Electric Construction Company.—The first interim dividend at the rate of 6 per cent. actual (12s. per share) in respect of 1920 has been declared.

Manila Electric Railroad and Lighting Company.—The usual quarterly dividend of 1½ per cent. on the common stock for the current quarter is announced.

The British Aluminium Company, Limited.—A dividend is announced of 8 per cent. per annum, less tax, on the ordinary shares for the six months ended June 30.

Dumbarton Burgh and County Tramways.—Directors' report states that profit, including amount brought in, was £9,244, and available balance was £5,650. Directors propose a dividend at the rate of 5 per cent. on the ordinary shares, less tax, carrying forward £1,276.

Stewarts and Lloyds.—The directors recommend an increase in capital to £4,100,000 by the creation of 917,500 deferred shares of £1 each. Of these shares 850,000 will be allotted to the shareholders of Alfred Hickman, Limited, in exchange for an equal number of their ordinary or participating preference shares. They will also receive 7s. 6d. in cash for each share surrendered. Brigadier-General T. E. Hickman, M.P., Mr. W. Hutchinson, jun., and Mr. S. J. Lloyd will join the board of Stewarts and Lloyds, Limited.

Aberdeen Tramway Finances.—Mr. D. W. Beaton, convener of the Aberdeen Tramways Committee, commenting on the accounts of the undertaking (which were summarised in our issue of September 11) said that the finances were in a very sound position, but they would have to take every care and precaution to build up strong renewal and reserve funds for the time, which was inevitable and not far distant, when reconstruction of track and renewal of cars on a large scale would have to be faced. They had had to postpone the building of 20 new cars on account of the expense, but that was only putting off the evil day.

Leeds City Tramways.—The general manager (Mr. J. B. Hamilton) has issued a statement showing the total revenue and total costs of operation covering the period from July 29 to September 1, 1920. The traffic and sundry revenue amounted to £102,780, and the expenditure to £99,876, leaving a surplus of £2,904. For the corresponding period a year ago the receipts were £87,708, the increase for the present year being £15,072. The result from April 1 to September 1 shows an average daily deficit of £157. The improved result of the past five weeks is due mainly to the inclusion of the Bank Holiday season in the period.

Mexico Tramways.—The *Financier* states that the Committee in London which is protecting the interests of bondholders in the Mexico Tramways Company hopes to publish an interim report on the position in Mexico within a few weeks. If conditions remain favourable, a detailed report and balance sheet of the accounts of the company will be issued early next year. After being under the control of the Government since October, 1914, the undertaking was returned to the company in May, 1919, and the accounts have not been published since 1913. In common with other Mexican concerns, the tramway company has its claims on the Government which have yet to be settled.

East Ham Tramways.—The accounts for the year ended March 31, show that there is a gross loss on the revenue account of £9,151; this amount, together with £395 in respect of active service allowances, makes a total of £9,546 carried to the net revenue account, as compared with £3,759 for the previous year, an increase of £5,787. After charging interest on and repayment of loans including contribution to sinking funds, amounting to £12,204, together with the sum of £300 transferred to special reserve fund, and a deficiency brought forward from the previous year of £11,474 which was borne by the borough rate, there remains a deficiency at the close of the year of £21,655, as compared with £11,474 for the year 1918-1919.

Bombay Tramways Company.—The extraordinary general meeting of the shareholders of the Bombay Electric Supply and Tramways Company, Limited, was held at Bombay on September 2. Sir Sassoon J. David presided and said the object of the meeting was to carry a stage further the reconstruction of the company, which had been approved. On receiving the unanimous approval of the shareholders in India and England, the English courts had had no hesitation in sanctioning the transference of all the business of the company to India. It was now necessary formally to complete that process to liquidate the existing company in order that its business might be transferred to the rupee company to be registered in India. All the resolutions necessary for the liquidation of the company were then passed unanimously.

Preston Corporation Tramways.—The annual report shows that the revenue for the year ended March 31 was £89,300 19s., working expenses and war service allowance £65,931, and gross profit £23,369. The charges against the latter for sinking fund, income tax and interest amounted to £17,446. The net balance, including the £6,530 brought forward, amounted to £12,454, out of which £5,000 was contributed to the rates, £1,717 revenue contribution to capital outlay, and £4,000 to reserve fund, leaving a balance on revenue account of £1,739. The total reserves at March 31 amounted to £55,853. Mr. J. F. Simpson, engineer and manager, says that it is obvious that the ever increasing expenditure necessitates a corresponding increase in revenue if the department is to retain its financial stability. Working expenses per car mile have increased from 6·92d. in 1903-4, to 13·62d. in 1919-20, or 96·8 per cent. The increase in fares to meet this additional cost has been 50 per cent. (1d. per mile to 1½d. per mile).

Auckland Electric Tramways Company, Limited.—The twenty-third ordinary general meeting of the Auckland Electric Tramways Company, Limited, will be held on Wednesday next at the Electrical Federation Offices, 88, Kingsway, London. The report and statement of accounts records the completion during the year of the arrangements connected with the sale of the undertaking to the Corporation of the City of Auckland as from July 1, 1919. The amount payable by the Corporation in accordance with the contract for sale was finally agreed at £1,227,201 8s. 7d., payable as to £834,400 in debentures of the Corporation bearing interest at 5¼ per cent., £392,800 in debentures bearing interest at 5 per cent., and £1 8s. 7d. in cash, the whole of the debentures carrying interest from July 1, 1919, and being redeemable at par on July 1, 1940. During the year £117,700 of the 5¼ per cent. debentures were sold at the price of £98 per cent. The revenue for the year was composed principally of interest upon the Corporation debentures, less interest paid on loans and advances, and amounted to £63,083 1s. 8d. After providing for all expenses chargeable to revenue, including £17,855 2s. 6d. for debenture interest, there is a balance on revenue account of £36,958 8s. 3d. making with £9,776 12s. 8d., the amount brought forward from the previous year, a total of £46,735 0s. 11d. The dividend on the preference shares paid and accrued to June 30 last requires £9,000, and the directors now recommend that a dividend be paid on the ordinary shares of 1s. 3d. per share (less income tax), which will require £28,125 and leave £9,610 0s. 11d. to be carried forward to next account.

The Madrid Tramways.—The Madrid tramways, which have been in the hands of a Belgian concern since their inauguration, have been purchased by a Spanish group of financiers for 75,000,000 pesetas (says a telegram to the *Daily Telegraph*). The first instalment of 25,000,000 was paid last week in Brussels by the representative of the Spanish group, Senor Senen

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THREE DAYS' STRIKE AT NEWCASTLE.

One thousand tramwaymen employed by the Newcastle Corporation ceased work on Tuesday, September 21, and the tramways of the city were at a complete standstill until the following Friday.

The cause of the dispute was the refusal of a number of inspectors and time-keepers to join the Tramway and Vehicle Workers' Union, the men contending that those grades benefit in all the awards which are brought about by the efforts of the men's union. There are about 80 non-unionists, and the grievance concerned about 48 inspectors and timekeepers, and 36 motormen and conductors. Subsequently 30 motormen and conductors joined the union, but the other men remain as non-members.

There are, roughly, in the employ of the Newcastle Corporation tramways, 1,700 men, and over 1,000 motormen and conductors were out on strike. Work at the car sheds and the Power Station proceeded as usual, and the men employed in repairing the tramtracks in different parts of the city were still on duty. The only men apart from these who reported for duty were the inspectors and timekeepers. These, in all, numbered 41. Excepting very few they are members of the Amalgamated Managers and Foremen's Association, and their contention was that there was no necessity for them to be linked up with the Tramway and Vehicle Workers' Union.

After the men had been on strike for a day, the Tramways Committee invited representatives of the United Vehicle Workers' Union and the Amalgamated Managers' and Foremen's Association to meet them. The Sheriff, Alderman R. Mayne, chairman of the Tramways Committee, presided over the meeting, and the result of the conference was the following statement, setting out the Committee's position—

(1) That the Tramways Committee approve of the principle that their employees should be members of a trade union.

(2) That the representatives of the United Vehicle Workers' Union and the Amalgamated Managers' and Foremen's Association agree that the question which has arisen between these two bodies shall be left to their Executives to decide.

(3) That the representatives in turn agree that their decision should be placed before their members, and their good office be used to get the system working to-morrow morning (Thursday).

This statement was considered by the men at a mass meeting on the Wednesday night, which was resumed on Thursday morning. A resolution was then passed unanimously, agreeing to accept the terms and the service was resumed on the Friday morning.

PERSONAL.

Mr. William Clark, a director of Vickers, Limited, has been elected as Master Cutler by the Cutlers' Company for the ensuing year.

M. Vedor, of the Bulgarian State Railways, recently visited London for the purpose of purchasing materials for that undertaking.

Mr. G. F. Nayler, electrical engineer and tramways manager to Nelson Corporation, has received an increase in his salary from £601 to £750 per annum, of which sum £297 10s. is to be considered as war bonus.

Mr. J. Thornton, London Underground Superintendent of the Line, was presented with a silver tea and coffee service and an illuminated address by the District Railway Athletic Association on retiring from the chairmanship of the Albert Stanley Institute. The presentation took place on September 15, when a pleasant musical evening was spent.

Messrs. J. B. Parker, late assistant rolling stock superintendent, and A. W. G. Woodward, late electrical foreman of the Sheffield Corporation Tramways and Motors Department, who have recently been appointed general manager and electrician respectively to the Tees Side Railless Traction Board, were the recipients of handsome presents from the workmen of the Sheffield undertaking. The presentation was made by Mr. J. Smith, rolling stock superintendent. Mr. Parker was recently presented with a gold watch by his colleagues on the staff of the Sheffield Tramways.

We regret to record the death of **Mr. W. Edgar Peckham,** the inventor of the Peckham truck, which occurred in London through heart failure on September 22. Mr. Peckham was in his 81st year. Some years ago he ceased to be connected with the company that bears his name.

Swiss Railway Electrification.—The equipment of the St. Gothard line was recently reported to be practically complete. Successful trial trips have been made from Erstfeld to Coeschenen. Previous trials below Airolo were also satisfactory. On the lower part of the line electric trains are being run at night, and it is reported that a regular service will soon be in operation.

TRAMWAY AND LIGHT RAILWAY NOTES.

ASHTON.

COST OF AN ARBITRATION.

The Ashton, Hyde, Denton and Audenshaw Councils are paying £4,000 towards the expenses of the arbitration proceedings in connection with their purchase of the undertaking of the Oldham, Ashton and Hyde Tramways Company.

BLACKBURN.

CARS COLLIDE IN A FOG.

Shortly after 7.30 a.m. on September 24 two Blackburn Corporation tramcars, travelling in opposite directions on the Accrington section came into collision. The front of each car was damaged, and they had to go into the depot for repairs. One of the drivers sustained cuts about the face with broken glass from the wind screen. The accident was due to one of the cars having overrun its points in the dense fog which prevailed.

BOLTON.

VEHICLES PASSING STATIONARY CARS.

Bolton Watch Committee have asked the chief constable to report with reference to the driving of vehicles past stationary tramway cars to the danger of the public.

BRIGHTON.

TRAFFIC DECLINE—THE RECENT WAGES DISPUTE.

The first six months of the financial year of the Brighton Corporation Tramways have not realised the full benefit anticipated from the revised charges. About £30,000 increased revenue was required to meet the abnormal expenses of labour and renewals. At the end of September the total advance was under £6,000. The tramway employees have made no move since the Corporation refused the request for the undertaking to be placed in Grade 1 instead of Grade 2. The tramways committee appear to have the support of the Council in their determination that if the men cause further trouble they are prepared to close the undertaking and train a fresh set of drivers and conductors.

COVENTRY.

REDUCING CONGESTION IN THE CENTRE OF THE CITY.

For the purpose of lightening the traffic at Broadgate, which has become at certain times a danger to pedestrians, the Watch Committee recently induced the tramways committee to transfer one of the tramway services to another street, and the police assigned fresh stopping and starting places to one of the omnibus services run in connection with the tramways. Owing to the decreased receipts and the complaints by the public, the Watch Committee have consented to the tramway service being restored, but they propose to abolish the omnibus stop at the King's Head Hotel in Hertford Street. As the tramways committee object to this course, the ultimate decision will be left to the next meeting of the Corporation.

DONCASTER.

TRACK RELAYING.

The Corporation have authorised the relaying of the double lines from Cleveland Street to Oswin Avenue. The cost is estimated at £42,000.

DUBLIN.

DIFFICULTIES DUE TO POLITICAL SITUATION.

An example of the difficulties experienced in Dublin as a result of the attempt of the Sinn Fein authorities to ignore the British Government and its departments is seen in the case of the Dublin tramways. The company running the undertaking decided to make application to the Ministry of Transport for power to increase fares. Members of the Dublin Corporation, when the matter came before them, refused to recognise the financial side of the matter, and were in favour of opposing the application. Eventually the Corporation decided to invite the company to submit the question of increasing fares to an Arbitration Court set up by Dail Eireann. The company, however, are in this position that, while they might be willing to adopt the latter course, they hold their statutory powers from the Board of Trade.

DUNDEE.

TRAMCAR COMEDY.

A section of the Dundee tramway service was held up for half an hour on September 13 by an incident which had its amusing side. A workman gave up his seat to a lady, and owing to the crowded state of the car he stepped on to the platform. Other passengers jumped on until the conductor, deciding on a clearance, ordered all on the platform to leave. Some did so, but the man who had already once had a seat declined to move, and the argument in which he and the conductor engaged lasted half an hour, until a long string of cars were blocking the thoroughfare. When the conductor asked the police to intervene they declined, saying that it was beyond their powers. Later the police ordered the conductor to proceed because of the obstruction he was causing.

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EDINBURGH.

REMOVAL OF EMBARGO ON EXCESS PASSENGERS—MOTOR SERVICES EXTENDED—NO CURRENT FOR TRAMWAY CARS BEFORE 1922.

Mr. J. Veitch, divisional representative of the United Vehicle Workers, writing in reference to withdrawal of the embargo on overcrowding on Edinburgh tramcars, says, "The members have agreed to the restrictions of overcrowding being withdrawn pending discussion and a satisfactory settlement of their complaints. Referring to the restrictions on men working overtime, i.e., working more than six shifts in one week, the members see no reason to depart from their resolution, which states that any employees persistently working more than six days each week will be asked to resign." It is anticipated that the cable cars of the Edinburgh Corporation running over the northern routes will be withdrawn and motor omnibuses substituted. An order has been placed for 29 single-deck type vehicles, and as an experiment one double-deck omnibus with covered top has been ordered. The tramways committee inspected one of the "K" type omnibuses which have been supplied to the London General Omnibus Company by the Associated Equipment Company. At a meeting of the Electric Lighting Committee of the Town Council it was stated that no current could be supplied for electric cars until 1922, when it is probable that a section of the Portobello station would be ready.

GLASGOW.

RECKLESS DRIVING CONVICTION—WAGES DEMANDS.

At Giffnock Justice of Peace Court on September 24, Charles Quin, tramway car driver, was convicted on a charge of recklessly driving a Glasgow Corporation car on Sunday, August 29. A fine of five guineas, with the alternative of 30 days' imprisonment, was imposed. At a joint meeting of Glasgow tramway workers belonging to the Municipal Employees' Association and the United Vehicle Workers' Union decided on September 26 to make common cause in demanding increased wages and improved conditions of service. The two unions have hitherto acted apart, and recently they presented to the Corporation separate applications for higher wages. The joint demand is an amalgamation of the claims formerly put forward by the unions separately, the principal points of it being a request for a minimum of £4 per week in wages and an application for adoption of the full terms of the March agreement of 1919. This agreement was a settlement come to on a national basis, which, if applied to Glasgow, will mean a considerable modification on the system of working shifts which is in operation at present.

HALIFAX.

TRAMWAY EXTENSION.

The tramways committee of the Halifax Corporation has decided to lay the tramway track to Stainland as speedily as possible. Rails have been difficult to obtain, and delay has been caused by the shortage of cement, but promises of delivery have been made.

HUDDERSFIELD.

FREE CONVEYANCE OF LUGGAGE.

The Corporation have decided that tramway passengers shall be allowed free conveyance of luggage or merchandise up to 28 lb.

HULL.

OLD AGE PENSIONERS AND FREE RIDES.

Reporting on the question of allowing old age pensioners to ride on the tramcars free, Mr. E. S. Rayner, manager of Hull Corporation Tramways, says there are 5,000 such persons in Hull. Calculating on three return journeys per week per pensioner, the cost would be £200 per week. The service could not carry this additional load even in slack times. Having regard to the reduction in passengers due to increased fares, Mr. Rayner calculates that there will be only a small margin at the end of the year, and that the granting of the concession would necessitate a further increase of fares. The tramways already carried free 500 blind persons and legless ex-service men, and the granting of any further concession would open the door to claims from inmates of workhouses and charitable institutions.

IPSWICH.

ELECTRICITY FAMINE.

There was a restricted tramway service at Ipswich in the last week in September owing to a failure of the insulation in the electrical circuits of the new 3,000 kilowatt turbine plant. Supplies of current to houses and factories were also curtailed.

LANCASTER.

RUNAWAY CAR.

Dead leaves caused a serious tramway mishap on September 27. A crowded workmen's car ran away down a gradient, crossed the road, and then crashed into a wall. A man who was passing the spot at the time was caught by the car and had both legs severed, dying soon after. The mishap is said to have been due to the slippery condition in which the track had been rendered by soaked leaves. The car was badly damaged.

LONDON.

NEW CARS FOR LONDON COUNTY COUNCIL TRAMWAYS—FRAUDULENT TRAVELLING CONVICTIONS.

The London County Council have invited tenders for 125 complete bodies for electric tramway cars, for 125 sets of maximum traction bogie trucks, and the same number of sets of electrical equipments. Particulars may be obtained from the Clerk of the Council, and tenders are due on October 25. The Metropolitan, London United and South Metropolitan Tramways are meeting with some success in their efforts to lessen the activities of passengers who fail to tender their fares. Officials are detailed for the detection of offenders, with the result that several prosecutions have been successfully undertaken. Two of these relating to the first-mentioned undertakiug have been embodied in a neatly designed poster issued from the Electric Railway House, and copies are displayed on the cars and in advertising positions. A most satisfactory feature of the two cases is the amount of the penalties imposed by the justices. For leaving a car at Willesden without payment of an additional fare for the distance travelled beyond the point to which the original fare was paid, the fine was £2 1s., including costs. A Highgate passenger who left a car without paying the fare was fined £4 2s., including costs.

MANCHESTER.

COUNCIL VISIT TO CAR WORKS AND DEPOT—MOTOR TRAFFIC AND TRAMCAR STOPS.

Members of the Manchester City Council paid a visit, on September 8, to the Hyde Road Car Works and Depot and the car sheds in Princess Road and Queen's Road. In connection with the visit the tramways committee issued a neat little brochure containing details of the undertaking. The Hyde Road car shed and depot opened in 1903 provides employment for 1,688 workmen. Recently, on the advice of their general manager, Mr. J. M. McElroy, the tramways committee bought 13½ acres of land on the north-eastern side of the depot, and it is proposed to extend the works and provide a new permanent way depot. The car works, opened in 1905, employ 566 men on new cars and repairing and maintaining the rolling stock. The Princess Road car shed, employing 1,498, was opened in October, 1909. It is the most modern of the Corporation's sheds, and extensions are being made to provide accommodation for 42 additional cars. The total number of employees in the service of the tramways department is 6,120, and the weekly wages bill is £23,500. The suggestion made by Alderman Ashton, and approved by the City Council, that motor vehicles should be compelled to stop whilst a tramcar unloads its passengers before they pass it is to form the subject of a clause in the next Parliamentary Bill promoted by the Corporation.

MEXBOROUGH.

REARRANGEMENT OF FARES AND STAGES.

The Mexborough, Swinton and Rawmarsh Councils have agreed to withdraw their opposition to the application of the Mexborough and Swinton Tramways Company for power to raise their fares. The company have made considerable concessions in the rearrangement of stages.

OLDHAM.

ARBITRATION AWARD.

The arbitrator's award on the acquiring of the Oldham, Ashton, and Hyde electric tramways by the local authorities of Ashton, Hyde, Denton and Audenshaw has been received. The total purchase price has been fixed at £142,000. The price asked by the company was £200,000. A settling day will be fixed by the respective authorities when the money will be paid over, and the tramways will then be run by the Corporations of Ashton and Hyde, Manchester (through Denton and Audenshaw), and the Stalybridge, Hyde, and Mossley Joint Board. Eventually a through service of cars will be run from Manchester to Hyde, and will join up to the Stockport Corporation Tramways.

PAISLEY.

FARES APPLICATION.

With reference to the application by the Paisley District Tramways Company for power to increase fares, the company have agreed to amend the application so that the minimum fare will be 1½d., instead of 2d. The Paisley Town Council have decided under the circumstances to offer no opposition.

PRESTON.

MOTORMEN'S REQUEST FOR VESTIBULES.

At a meeting of the tramways committee a deputation representing the motormen asked that the fronts of the cars obtained from the Sheffield tramways be covered in. The tramways engineer was instructed to cover in four of the cars for experimental purposes, at an estimated cost of £150 per car.

SCARBOROUGH.

SUSPENSION OF SERVICES.

Scarborough Tramways Company has informed the Town Council that the service will be suspended on the North Side route this winter owing to the heavy loss incurred last year.

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SHEFFIELD.

GRANTS FROM TRAMWAY PROFITS.

The tramways and motor committee of the Sheffield Corporation recommended a discontinuance of the grants which have been made hitherto to a number of associations and institutions. This decision will be welcomed by all who agree with the policy so frequently advocated in THE TRAMWAY AND RAILWAY WORLD that the tramways should be run like other commercial undertakings on a strictly business footing. The grants referred to at Sheffield during the past year were the following—Contribution to Sheffield and District Rifle Association, £200; contribution to Workers' Educational Association, £15; contribution to cost of music in the parks, £200; annual grant to the Sheffield Institution for the Blind, £25; grant to prize fund for war time allotments, £200; contributions for expenses of exhibition of naval photographs, Mappin Art Gallery, £162 10s.; grant towards expenses of Development Committee, £500.

TEES-SIDE.

SPECIAL CASE FOR DECISION IN TRAMWAYS ARBITRATION.

The arbitration award fixing the price to be paid by Middlesbrough, Stockton and Thornaby for the Tees-side tramways gave those authorities the option of stating a special case for decision by the House of Lords. The three Councils have decided to state a case on the following points—Interest on capital during construction, the cost of raising capital, engineers' and architects' fees, the value of the plant at the power-house, and the value of the cars.

WOLVERHAMPTON.

CHAMBER OF COMMERCE PREFERS OMNIBUSES.

The Wolverhampton Chamber of Commerce has addressed a letter to the Corporation urging that the scheme for converting the tramway system (surface contact) to overhead wires should be dropped, and a scheme of omnibuses substituted.

YARMOUTH.

TRAMWAYS OR OMNIBUSES.

A report is to be prepared by the Town Clerk, the accountant, and the tramway manager of Yarmouth regarding the financial position of the tramways and the desirability of substituting omnibuses for the present system.

CONTRACTS AND ORDERS.

Leigh Corporation have ordered six "A" type chassis from Straker-Squire, Limited.

Northampton Corporation have placed a contract with Mr. G. Hartigan for the relaying of tramway lines at £5,702.

Northampton Corporation have authorised the borough engineer to purchase a Foden Steam Lorry as a cost of £1,275.

Ashton-under-Lyne Council have accepted the tender of Mr. J. Ridyard, at £5,380, for the erection of a shelter for tramway passengers, with parcels office, lavatories, etc.

Messrs. C. A. Parsons and Company's tender has been accepted by the Western Australian Government for a 7,500 K.W. turbo-alternator for the Perth central power station.—Tenders.

Straker-Squire, Limited, of Edmonton, London, N., have received an order from Newcastle Corporation for thirteen of their "A" type chassis, which are to be fitted with single-deck bodies.

Manchester Electricity Committee have accepted the tenders of the Metropolitan-Vickers Electrical Company for h.t. switch gear, and of Callenders Cable and construction Company for cables.

Liverpool Corporation have accepted the tender of the Metropolitan Vickers Electrical Company, Limited, for the supply and erection of a 12,500 K.W. turbo-alternator and accessories at Lister Drive station.

The Brush Electrical Engineering Company, Limited, have notified East Ham Tramways Committee of a further increase in the contract price of four cars on account of the increased cost of railway carriage and increased wages.

Manchester Tramways Committee have placed contracts as follows—Equipment and Engineering Company, universal type rail-grinding machine; Hitchcock, Lloyd and Company, Limited, reciprocating rail-grinder.

Bradford Tramways Committee have recommended acceptance of the tender of Hadfields, Limited, of Sheffield, at £6,239, for rails and crossings required in connection with the construction of the tramway centre in Forster Square.

Portsmouth Electricity Committee have accepted the tender of Messrs. Babcock and Wilcox, Limited, at £33,000 for boilers, and have recommended the acceptance of the tender of the Metropolitan Vickers Company, at £36,500 for the supply of 4,000 K.W. turbo-alternator and water tube boilers.

PATENT LIST

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Overhead collectors for electric tramways and railways (25,177)—W. B. Blackburn.
Operating brakes of motor vehicles (25,090)—E. L. Crosland and J. Crosland.
Means for coupling trailers to power-driven vehicles (25,070)—T. M. Day and D. H. Higgins.
Car brake and power controlling devices (25,209)—C. C. Farmer.
Control mechanism of motor vehicles (25,459)—N. T. Ford.
Automatic high-speed compressed air brakes (25,547)—E. Franchimont.
Motor vehicles (25,165)—E. Groves.
Automatic train control systems (25,383)—W. K. Howe.
Traffic safety device (25,326)—G. W. Kent.
Signalling devices for road vehicles (25,117)—King's Patent Agency (*V. Tradigo*).
Rail joints (25,213)—R. A. C. Laidlaw.
Lifting jacks (25,328 and 25,329)—Lane Brothers Company.
Rail joints (25,229)—C. Lynn.
Automatic electric sub-station systems (25,464)—Metropolitan-Vickers Electrical Company (*Westinghouse Electric and Manufacturing Company*).
Driving mechanism for motor vehicles (24,999)—J. H. Morris.
Lifting jacks (25,540)—A. D. Powell.
Motor vehicles (25,494 and 25,703)—L. Rousseau.
Wheel and axle assembly for motor vehicles (25,712)—S. E. Alley and H. K. Pratt.
Clutch controls for motor vehicles (26,016)—W. H. Baker and L. Pellat.
Overhead tramway, etc., systems (26,123)—J. Boydell and W. Boydell and Sons.
Speed, mileage, and route indicator (25,940)—F. Croft.
Trolley poles (25,576)—J. Fitzgerald.
Trolley heads of electric tramcars (25,599)—A. Harwood.
Change-speed gears for motor vehicles (25,805)—Oesterreichische Waffenfabriks Ges.
Staircase lift for omnibuses and tramcars (25,958)—S. G. Whitehouse.
Lifeguard (25,924)—C. Whittle.
Supporting devices for overhead contact and trolley wires (26,408)—J. W. Astley and British Insulated and Helsby Cables, Limited.
Means for actuating braking devices by electric current for rail vehicles (26,655)—G. P. Bartlett and W. H. Taylor.
Covers for omnibuses and tramcars (26,185, 26,410, and 26,681)—F. C. Boughton.
Motor vehicles (26,470)—W. Bradley.
Lifting jacks (26,566)—S. R. Fairclough and W. Williams.
Means for supplying liquid fuel to motor vehicle engines (26,349)—H. T. Knox.
Brake and change lever pedals of motor vehicles (26,216)—P. Maggs.
Joint for tramway rails (26,505)—J. Roud.
Starting and lighting systems for motor vehicles (27,339)—H. M. Ainsworth and Soc. Anon. des Anciens Etabliesements Hotchkiss et Cie.
Front guards with buffers for motor vehicles (26,750)—J. Chaplin.
Tipping mechanism for motor vehicles (26,993)—A. Craig.
Automatic brake appliance (27,317)—O. Dalton, W. T. Dalton, and A. Townshend.
Bodies of motor vehicles (27,105)—A. Dobson.
Bodies of thermo-electric self-propelled vehicles (27,042)—W. P. Durtnall.
Driving of motor vehicles (27,208)—W. P. Evans.
Life-saving device for motor vehicles (26,908)—T. L. Fairclough.
Signalling devices for tramcars (26,846)—F. Aspden.
Supporting, driving, or transmission gear in motor vehicles (27,037)—F. Graf, H. Graf, and K. Graf.
Electric power plant for steam railways (27,092)—R. J. Insell.
Motor-operated starting mechanisms for automobile engines (26,914)—Metropolitan-Vickers Electrical Company.
Means for establishing intercommunication between front and rear engines in electric trains (27,041)—H. Parodi.
Rail fasteners and joints (26,995)—E. S. Rayner.
Rail joints (27,307)—C. A. Rowbotham.
Combined bumper and lifting jack for motor vehicles (26,825)—G. Sjolander.
Extra-air device for internal combustion engine of motor vehicles (26,832)—J. V. Wilmoth.

SPECIFICATIONS PUBLISHED

1919.

Folding hoods for motor vehicles (8,266—*149,028*)—J. Brockhouse and Company and J. T. Brockhouse.
Motor road vehicles (11,002—*149,052*)—M. Brown.
Back axles of motor-driven vehicles (11,047—*149,054*)—J. Y. Sangsten.
Steering wheels of self-propelled vehicles (16,131—*149,119*)—J. Stoddart.

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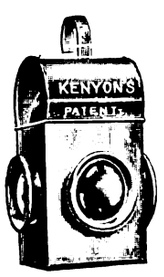

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Electric signalling systems (21,415—*149,139*)—Western Electric Company (*Western Electric Company*).
Composite electric signalling systems (23,394—*149,146*)—Western Electric Company (*Western Electric Company*).
Differential and variable speed gear for motor road vehicles (11,610—*149,407*)—A. J. Berry and G. M. M. Berry.
Electric traction motors (11,682—*149,411*)—W. E. Ireland.
Motor fire engines and rail coaches (12,286—*149,445*)—Tilling-Stevens, Limited, and H. H. Carter.
Power transmission mechanism of locomotives, railway motor cars, etc. (12,633—*149,450*)—Baguley Cars, Limited, and E. E. Baguley.
Check rails for permanent way (27,207—*149,559*)—A. E. Nurding.
Suspension of road vehicles (8,629—*149,717*)—E. B. Killen.
Vehicle suspensions (8,821—*149,718*)—S. J. Waters.
Fluid pressure brake apparatus (11,882—*149,720*)—British Thomson-Houston Company (*General Electric Company*).
Motor vehicle driving mechanism (12,394—*126,973*)—Auto-Motive and Accessory Export Company.
Starting handles of motor vehicles (18,394—*149,833*)—J. Stanley.
Electric signalling systems (24,173—*149,858*)—Western Electric Company (*Western Electric Company*).
Motor tip wagons (12,769—*150,034*)—E. R. Walker and Walker Brothers.
Motor road vehicles (12,885—*150,038*)—W. E. H. Johnstone and R. E. Simpson.
Brake mechanism of road motor vehicles (13,323—*150,066*)—W. T. Bell and F. J. Bretherton.
Trolley heads for electric traction (14,909—*150,108*)—Brecknell, Munro and Rogers and A. M. Willis.
Electricity collectors (15,521—*150,120*)—British Insulated and Helsby Cables, Limited, and J. W. Astley.
Rail bonds (15,596—*150,122*)—J. Mather.

1920.

Bonnets for motor vehicles (6,868—*149,184*)—J. Y. Sangster.
Means for forced lubrication for locomotive and similar vehicles (3,153—*138,617*)—Aktiebolaget Ljungstroms Angturbin.
Storage battery for locomotives (7,386—*140,105*)—Mancha Storage Battery Locomotive Company.
Brakes for use on automobile vehicles (12,637-*149,902*)—R. Schmitz.
Direction indicators for motor vehicles (4,099—*150,233*)—A. E. Collins.

LONDON COUNTY COUNCIL.

COMPETITION FOR ELECTRIC TRAMCAR DESIGN.

The London County Council invites engineers and others possessing the requisite technical knowledge to submit designs for a new type of electric tramcar for use on its tramways.

The competition will be open to persons of any nationality and whether resident in Great Britain or not. No person in the service of the Council will be eligible to compete.

The designs will be assessed by Mr. A. L. C. Fell, general manager of the Council's tramways, and an engineer nominated by the President of the Institution of Civil Engineers.

The conditions of competition provide for the award of a prize of £1,000 to the competitor who sends in the design which it is decided by the assessors is the best of those submitted, and which complies with such conditions.

The designs, accompanied by the necessary reports, specifications, etc., must be delivered at the competitor's own expense not earlier than November 1, and not later than 4 p.m. on Tuesday, November 30, 1920. Applications for conditions, plans, etc., relating to the competition should be addressed to the General Manager, London County Council Tramways, No. 23 Belvedere Road, London, S.E.1.

Competitors, on payment of a sum of 2 guineas, will be furnished with a general drawing of the type of car at present in general use on the London tramways system, accompanied by the more important particulars relating thereto. This amount will be returned to each competitor who submits a *bona-fide* design and does not subsequently withdraw the same, and also any person who, on receipt of the conditions, etc., decides not to compete and returns the copy of the drawing, etc., referred to above, within two weeks.

JAMES BIRD,
Clerk of the London County Council.

MODEL TRAMWAY CAR.

WANTED

Use of Model Electric Tramway Car Body, mounted on truck. Address—M. T., c/o TRAMWAY AND RAILWAY WORLD, Amberley House, W.C.

Back Numbers of several issues of THE TRAMWAY AND RAILWAY WORLD wanted. Write—M. B., c/o TRAMWAY AND RAILWAY WORLD.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1919. WEEKS ENDED					1920. WEEKS ENDED.					AGGREGATE.		
	Sept. 6	Sept. 13	Sept. 20	Sept. 27		Sept. 4	Sept. 11	Sept. 18	Sept. 25		Wks.	1920.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare Corporation	...	...	...	...	...	...	...	...	...	...	—	—	—
Aberdeen Corporation	3,653	3,659	3,415	3,022	...	4,367	4,175	3,847	3,678	...	16⅞	69,321	+ 10,896
Ayr Corporation	723	771	1,526	645	...	816	795	1,639	748	...	19	19,257	+ 1,163
Barrow Corporation	840	...	...	734	...	1,010	...	...	956	...	25	22,875	+ 2,100
Belfast City Tramways	10,657	10,838	10,637	10,254	...	10,282	10,554	11,088	11,483	...	26	299,264	+ 30,368
Birkenhead Corporation	3,196	3,189	3,093	3,254	...	3,345	3,517	3,339	3,402	...	25½	88,269	+ 13,369
Birmingham Corporation	26,050	26,327	25,421	26,819	...	33,831	34,015	34,663	33,891	...	26	770,566	+ 104,324
Birmingham Motor 'Buses	1,701	1,871	1,634	1,717	...	2,081	2,121	2,114	2,026	...	26	52,843	+ 7,092
Blackburn Corporation	2,341	2,697	2,811	2,085	...	3,119	2,767	3,300	3,209	...	25⅝	69,757	+ 7,244
Bradford Corporation	11,404	11,897	11,398	11,815	...	12,742	12,556	13,177	12,442	...	26	321,694	+ 22,958
Burnley Corporation	3,098	3,641	3,043	3,242	...	3,522	3,914	3,775	3,742	...	—	—	—
Burton-on-Trent Corporation ...	543	529	529	529	...	625	625	661	631	...	26	153,129	+ 2,161
Bury Corporation	2,506	2,436	2,415	2,571	...	2,581	3,239	2,761	2,938	...	25½	69,130	+ 5,535
Chatham and District	1,753	1,855	1,703	1,525	...	2,042	1,958	1,980	1,831	...	38	66,073	+ 7,210
Cork Electric	888	979	876	823	...	795	848	789	726	...	38	31,221	+ 4,801
Derby Corporation	2,166	2,157	2,002	2,021	...	2,513	2,173	2,212	2,237	...	26	58,396	+ 7,515
Dundee City	2,678	2,690	2,627	2,547	...	3,421	3,301	3,276	3,351	...	18½	54,599	+ 6,140
East Ham Corporation	1,870	2,021	2,026	1,896	...	2,084	2,100	2,124	2,100	...	25⅝	50,292	+ 1,043
Edinburgh Corporation	11,035	10,775	11,041	10,270	...	11,708	11,500	11,669	12,343	...	19	238,830	+ 10,974
Edinburgh Motor 'Buses	...	...	...	...	...	882	965	931	1,050	...	19	16,348	—
Glasgow Corporation	33,560	33,348	33,313	33,553	...	46,693	45,833	47,566	46,640	...	16⅛	725,200	+ 188,990
Glossop (Urban Elec. Supply Co.)...	237	249	228	245	...	264	274	299	279	...	39	9,010	+ 284
Huddersfield Corporation	4,880	5,506	4,769	5,125	...	5,584	5,957	5,596	5,546	...	26	130,382	+ 1,281
Ilford U.D. Council	1,277	1,261	1,214	1,210	...	1,336	1,331	1,401	1,396	...	25⅜	33,245	+ 1,939
Ipswich Corporation	1,179	1,188	1,028	965	...	1,091	1,077	1,078	1,027	...	24	26,779	+ 1,522
Isle of Thanet...	2,361	2,431	2,182	1,572	...	2,868	2,757	2,462	1,742	...	51	62,306	+ 13,535
Kilmarnock Corporation	288	288	295	288	...	380	380	389	374	...	19	7,043	+ 1,394
Lanarkshire	4,215	4,303	4,268	4,153	...	4,764	4,474	4,603	4,610	...	38	161,089	+ 22,248
Leeds City	...	...	...	...	...	...	...	...	...	...	—	—	—
Leicester Corporation	6,084	6,165	5,796	6,047	...	6,842	6,814	7,211	7,393	...	—	—	—
Leyton U.D. Council	3,104	3,278	3,151	2,991	...	3,043	3,059	3,220	3,061	...	26	80,059	— 2,404
Liverpool Corporation	23,953	24,845	24,254	24,649	...	28,748	28,017	28,797	28,160	...	38⅝	1,053,963	+ 208,610
London County Council	79,656	82,058	79,487	78,092	...	84,824	86,471	88,791	87,273	...	25	2,130,391	+ 100,202
Maidstone Corporation	434	474	445	433	...	520	540	599	514	...	25½	12,865	+ 2,508
Manchester Corporation	31,263	31,405	30,530	31,145	...	36,042	36,125	36,652	36,882	...	26	918,867	+ 34,232
Newcastle-on-Tyne Corporation ...	6,521	9,453	9,246	9,561	...	11,379	11,182	11,346	*6,696	...	24	277,528	+ 32,866
Nottingham Corporation	7,303	7,476	7,114	7,225	...	7,904	7,694	7,846	7,694	...	25	197,147	+ 12,084
Oldham Corporation	4,549	4,670	4,487	4,744	...	4,803	5,319	5,096	5,086	...	27	125,903	+ 5,253
Reading Corporation	1,699	1,779	1,672	1,606	...	1,764	1,739	1,826	1,737	...	25⅝	43,129	+ 1,601
Reading Motor 'Buses	...	...	...	...	...	306	316	296	293	...	25⅝	6,829	—
Rotherham Corporation	2,031	2,164	235	2,126	...	2,755	2,858	2,739	2,727	...	25	67,509	+ 14,534
St. Helens Corporation	...	...	...	...	...	2,478	2,230	2,532	2,321	...	25	53,288	—
Sheffield Corporation...	17,044	...	...	16,860	...	20,758	...	...	21,433	...	26⅜	556,575	+ 121,704
Southampton Corporation	2,790	2,906	2,790	2,620	...	3,518	3,472	3,501	3,311	...	25	79,274	+ 7,969
Southampton Motor 'Buses	102	114	110	96	...	244	229	250	229	...	25	5,681	+ 4,769
Southend Corporation	3,161	3,345	2,958	2,313	...	3,519	3,235	3,119	2,424	...	25	71,090	+ 6,193
South Shields Corporation	1,558	1,532	1,490	1,430	...	2,060	2,109	2,025	1,965	...	26	50,544	+ 13,628
Sunderland Corporation	3,018	3,059	2,835	2,791	...	3,215	3,206	3,075	2,978	...	26	81,124	+ 4,067
Swindon Corporation	411	440	409	397	...	439	419	422	419	...	25	10,007	+ 334
Tyneside Tramways and Tramroads	1,201	1,335	1,233	—	...	1,554	1,367	1,430	...	...	11	15,186	+ 807
Wallasey Corporation	2,689	2,803	2,588	2,420	...	2,744	2,676	2,643	2,622	...	25⅜	69,255	— 228
Walsall Corporation	1,641	1,641	1,622	1,692	...	1,759	1,737	1,824	1,726	...	26	45,322	+ 7,956
Walsall Motor 'Buses	577	584	583	606	...	1,247	1,246	1,290	1,219	...	26	28,430	+ 14,852
Walthamstow U.D. Council ...	1,803	1,883	1,750	1,716	...	2,072	2,153	2,154	2,064	...	25⅜	54,753	+ 8,756
Warrington Corporation	917	920	888	924	...	1,009	988	1,019	1,008	...	25	25,002	+ 2,852
West Ham Corporation	5,287	5,451	5,212	5,149	...	5,510	5,541	5,647	5,601	...	25½	137,862	— 654
Wolverhampton Corporation ...	1,999	2,069	1,983	2,157	...	2,509	2,467	2,498	2,386	...	25	61,718	+ 10,695

*Results affected by Strike.

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1919. WEEKS ENDED.					1920. WEEKS ENDED					AGGREGATE.		
	Sept. 6	Sept. 13	Sept. 20	Sept. 27		Sept. 4	Sept. 11	Sept. 18	Sept. 25		Wks.	1920.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	60,861	65,111	65,832	61,846	...	77,069	80,204	79,336	79,277	...	38	2,870,079	+ 708,650
Calcutta ... ... Rs.	90,272	91,767	93,998	91,238	...	101,182	102,122	99,989	89,782	...	38½	3,590,896	+ 287,977
Madras... ... ... Rs.	(2 weeks)	51,193	(2 weeks)	44,557	...	(2 weeks)	55,962	(2 weeks)	50,708	...	37	896,649	+ 152,637
Pernambuco	5,640	5,582	6,196	5,606	...	5,991	5,604	5,684	5,521	...	38¼	264,033	+ 64,599

Companies issuing Monthly Statements only.

	1919.						1920.						Wks.	AGGREGATE.	
	April	May	June	July	Aug.	Sept.	April	May	June	July	Aug.	Sept.		1919-20.	+ or —.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	4,291	3,266	3,261	2,982	...	...	4,933	3,672	3,671	3,689	...	...	16	15 965	+ 2,163
Brazilian Trac. Mlrs	9208,000	9562,000	9369,000	10,070,000	9734,000	...	10245000	10985000	10874000	11745000	11837000	...	35	84,622,000	+ 10855,000
Brisbane	38,775	...	...	41,610	42,245	...	44,890	...	...	53,300	46,650	...	35	367,590	+ 63,190
British Columbia $	631,988	628,847	411,605	642,090	...	...	749,081	720,004	710,210	740,200	...	...	4	740.200	+ 98.110
Buenos Ayres L'c'z.	43,605	47,319	61,356	45,222	46,846	45,310	53,429	54,563	50,635	51,508	53,952	53,603	13	159,063	+ 21,685
Burma	36,814	38,900	41,516	44,050	43,683	...	44,673	46,785	50,471	52,289	48,552	...	4	48.552	+ 4,869
Cape Town ...	22,564	23,405	...	12,792	...	...	25,010	24,395	...	23,711	...	...	—	—	—
Carthagena & H. ...	1,786	3,226	3,373	4,183	2,991	1,539	5,482	5,313	5,562	4,164	3,721	2,273	39	38,764	+ 13,260
Cordoba	...	...	17,188	18,308	...	...	...	...	20,056	20,197	...	...	17	79,795	+ 10,192
East India ...	1,920	2,131	2,323	2,687	2,761	...	3,916	3,980	3,862	4,081	4,109	...	4	4,109	+ 1,348
Kalgoorlie	2,907	2,796	2,646	...	...	...	3,246	3,276	3,029	...	...	...	26	17.943	+ 2,101
La Plata	5,631	...	...	5,317	5,729	5,541	6,142	...	...	5,353	5,715	5,656	39	49,868	— 1,175
Lima	49,980	42,974	47,855	49,022	...	...	57,415	54,969	55,919	59,685	...	...	30	402,868	+ 70,800
Manila ... $	212,205	202,449	160,714	189,653	...	...	254,102	280,145	267,169	282,260	...	...	30	1,904,254	+ 488,095
Monte Video ...	...	37,382	34,750	34,039	34,873	...	...	42,401	39,989	39,647	42,771	...	43	429,706	+ 60,757
Para	25,342	24,503	24,647	24,659	24,890	...	24,771	25,842	25,403	24,254	24,582	...	39	222,756	+ 1.130
Peruvian ... $	...	1059,150	...	...	...	...	...	1287,070	...	...	...	...	—	13274,884	+ 1,966,779
Port Elizabeth ...	5,576	5,145	...	3,247	...	...	6,381	6,165	...	...	6,106	...	—	—	—
Rangoon	6,217	6,533	6,276	6,562	6,472	...	7,857	7,933	7,849	7,911	7,856	...	34	63,238	+ 11,578
Toronto ... $	1051,960	1032,717	842,697	977,262	...	...	1211,708	1206,930	1127,239	1189,315	...	...	30	8,235,063	+ 1,124,505
Winnipeg ... $	367,196	248,191	112,615	337,978	...	...	431,685	404,742	407,625	391,709	...	...	30	3,036,386	+ 823,768

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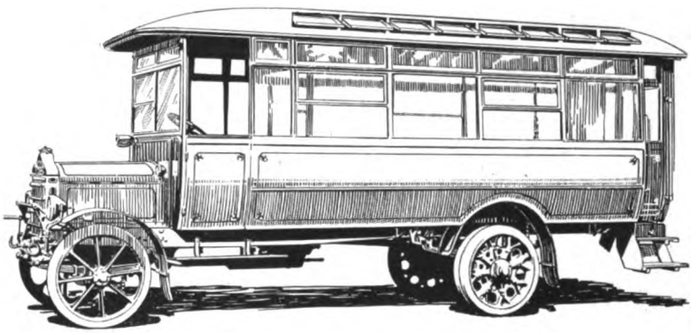
Daimler

This vehicle can be examined on
STAND 73 OLYMPIA.
¶ We are also showing a CHAR-A-BANCS and an all steel end-tipping LORRY with hydraulic tipping gear.



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This Chassis is specially designed as an economical and efficient vehicle, particularly suitable for passenger carrying. The arrangement of the driver's position at the side of, instead of behind the engine, increases length of loading platform by 3' 6" without adding to the overall length of the chassis. The design also allows a more even distribution of load on the axles and reduces the body overhang behind the rear axle. This feature, in conjunction with the specially designed springs, provides an exceptionally comfortable riding vehicle.

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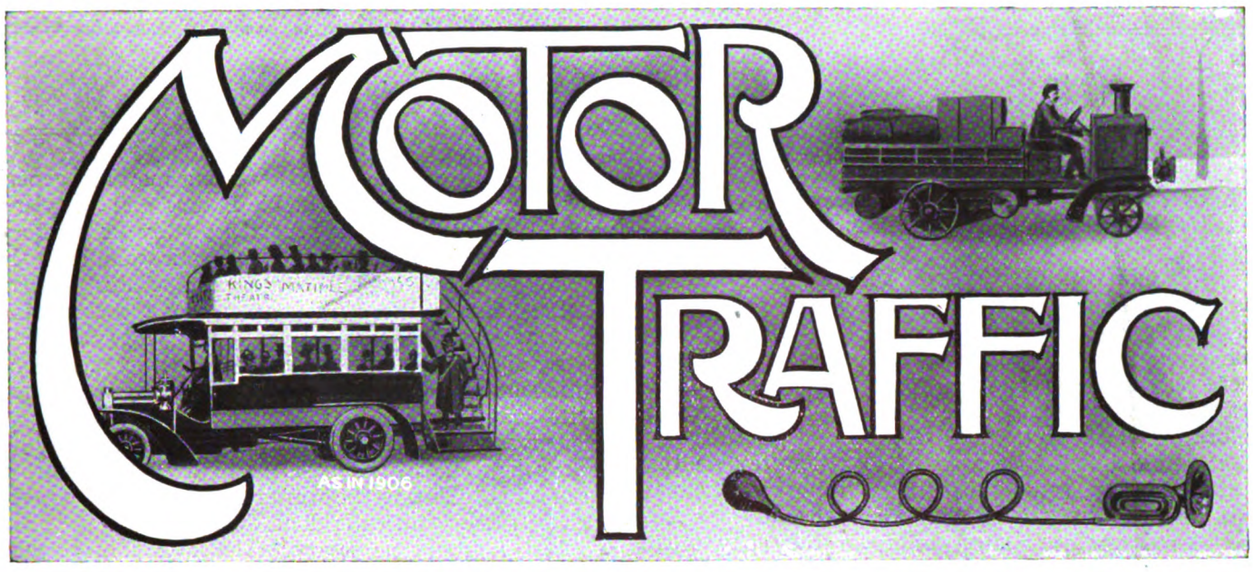

FUEL PRICES.

There has been much controversy in the Press on the subject of the recent increase in the price of petrol. The importers seek to justify this increase, but there are many who believe that it can only be justified, if at all, by the admission that people who have something which other people need are at liberty to sell it at the highest price the purchaser will pay. However this may be, the fact that matters to us most is that the public have no control and are not in the least likely to gain any control over the price of petrol unless they can so influence development as to bring large competitive supplies of motor fuel into existence. Up to the present, the tendency has been to view the whole fuel situation from too narrow a standpoint. We commented on this fact recently when criticising the report of the Fuel Research Board. The price of motor fuel as we are perpetually being told, is a natural result of the law of supply and demand. The fuel problem is a world problem and not one that should be regarded from a parochial or even a national standpoint. Hitherto, we have been much too prone to judge any suggestion for the introduction of a new motor fuel on the basis of the availability of that fuel at a competitive price in the British market as distinct from any other. The principle that needs to be inculcated is that, so long as the fuel can be produced and sold at the right price somewhere, its existence must have its natural effect on the relation between the world's supply and the world's demand. It is upon this relation that the price of petrol is mainly dependent. Thus, in the long run we should benefit almost, if not quite, as much if we were able to produce a fuel that would be extensively used, say, in India and Australia as we should do were we to produce the same quantity of fuel for immediate use in this country. Unless this principle be firmly grasped we shall never put our backs sufficiently into the work of creating a supply of power alcohol on a scale that makes the thing worth doing.

SIGNALS BY DRIVERS.

It seems quite within the bounds of possibility that the inquiry conducted by the Ministry of Transport into the question of the dangers resulting from the use of vehicles with left-hand drives will lead to rather a curious result. It is rumoured that there is an intention in official quarters to make it compulsory upon all drivers of road vehicles to give certain signals indicating their immediate intentions to following traffic. Thus, when a driver is about to stop he would hold his arm in one position, when he intends to turn he would hold it in another. The principle of mutual assistance by the regular giving of signals is a perfectly sound one, but we feel most strongly that this is a matter for education and persuasion rather than for compulsion. There will be very numerous cases in which it will be impossible for a driver to make his signal sufficiently visible to be of use. If signalling is compulsory then, presumably, if a signal were not given or could not be seen, the driver of a following vehicle could not be blamed in the event of an accident resulting owing to the preceding vehicle stopping or turning. The question of liability in case of accident would hinge on whether the signal had been given or not. In ninety-nine cases out of a hundred there would be directly conflicting evidence on this point. It is more than questionable whether the evidence of passers-by in respect of such a trifling matter as the raising of a driver's arm would be in any way dependable. Thus any compulsory regulations on the subject would probably lead to an increase in litigation and possibly to an increase in perjury. The position of a vehicle on the road at the time of an accident can frequently be proved beyond dispute. The question of whether or not a driver raised his arm could not be so proved and there would be few, if any cases, in which a driver involved in an accident would not insist that he had given the signal. The next step would probably be the compulsory carrying of signal arms at the back of every vehicle, operated by the driver, and unless these devices were absolutely reliable they would be responsible for more accidents than the absence of any signal at all is likely to involve. Altogether we think that the Ministry of Transport will be well advised to stop any proposals for compulsory signals. Incidentally these proposals appear to be solely due to the left-hand drive controversy and as such do not meet the case for which they are devised. Quite recently on the occasion of a fatal accident to a pedestrian, the coroner commented on the fact that the driver of the vehicle responsible could not possibly have seen the man because he—the driver—was on the left-hand side of his vehicle. No signalling system can get over the fact that a man in this position is less well situated than he ought to be from the point of view of seeing round traffic that is preceding him.

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MOTOR TRAFFIC

THE USE OF TRADE NUMBERS.

Another matter with regard to which the issue of new regulations appears probable is the use of trade or red numbers on motor vehicles. Hitherto, the principle underlying the existing rule has been that the motor manufacturer or trader should not be taxed when merely moving vehicles from point to point in the course of his trade, or testing them on the road. Undoubtedly, there has been some abuse of the use of red number plates, but very general abuse would have to be proved before the introduction of restrictive legislation, or what would in practice amount to a new tax on the motor industry, could be justified. If manufacturers and traders are to be made to pay heavily for the use of red number plates, whatever they pay must necessarily be recovered by them from motor users. If the use of red numbers is to be hampered by restrictions and by the need of keeping complicated records and conforming to endless formalities, then the cost of conducting a motor business will be forced up and again the motor user will have to pay if such businesses are to be continued at all. Their existence is, of course, a necessity and, therefore, any interference with the reasonably free use of red numbers would in the result amount to nothing more nor less than a new tax on motor vehicles. Not so long ago the motor industry was picked out and named by a very responsible official committee as one which had always been hampered by ill-advised legislation. It is time that this policy of pin pricks and irritation ceased. It is the business of the Ministry of Transport to improve our communications and to cheapen them, and it would do well to stick to this main duty and not to give way to an inordinate desire to justify its existence by the invention of hundreds of new regulations requiring the paying of fees and the filling in of forms, both these being processes that can only discourage enterprise and retard business.

IGNITION DEVELOPMENTS.

Unquestionably there is in many quarters a strong tendency to revert from magneto to battery and coil ignition. The latter is becoming very general on American motor chassis and there are many examples of its employment in this country. The question of whether a similar change ought to take place on the chassis of trade vehicles is, of course, a different one. The various components of the system are far better than they were in the days when the high tension magneto first came into use. Particularly, there has been a great advance in the design and construction of secondary batteries. On the other hand, it is absolutely certain that the magneto would have remained unchallenged had not the advantages of electric lighting and of electric engine starters been so considerable as to induce the great majority of motorists to regard the presence of a secondary battery on the chassis as a necessity. Once this necessity is admitted, and provided only that the battery proves thoroughly reliable, there is, of course, a strong inducement to dispense with the magneto and to replace it by a cheaper equipment including a coil and the necessary contact breaking and distributing mechanism. On the average commercial vehicle this same inducement does not exist, because the electric starting motor is generally regarded as an unjustifiable luxury and acetylene lighting is found to be at least reasonably satisfactory and cheaper than an electric lighting installation. It is, however, well worth considering whether when lighting and ignition are considered together, the additional cost, if any, of an equipment providing electric light and coil ignition as against acetylene lighting and magneto ignition would not be justified by its convenience. In judging between the two we must give proper credit to the distinct possibilities of electric lighting as the basis of night advertising on motor vans. During the winter months much of the work of these vehicles is done during the hours when artificial light is necessary. The availability of a thoroughly good electric lighting set makes it possible to illuminate posters or other advertisements and in some trades this form of publicity is certainly of considerable value. Thus, there is at least a strong possibility of electric light becoming more and more generally used on certain classes of industrial vehicle, and if this happens we shall immediately begin to feel the effects of the same factors as those which have caused the return of the coil ignition system on private cars. It is not probable that for some time to come very large numbers of trade motor vehicles will be equipped with starting motors, but even this development is at least possible on a comparatively small scale, because undoubtedly there are some service conditions under which the starting motor might lead to appreciable fuel economy, owing to the engine not being kept running while deliveries are being effected, provided that it can be immediately restarted without manual labour when it is desired to proceed with the journey.

MOTORISTS AND PETROL PRICES.

SUGGESTIONS FOR INCREASING FUEL SUPPLIES.

A statement issued by the Motor Legislation Committee makes the following suggestions for consideration by the Government—

1. That the agreement between the Anglo-Persian Company and the Shell Company be reviewed so that the distribution of motor spirit under the agreement be available through agencies independent of the two large trusts.

2. That all statutory gas companies having an annual consumption of not less than 5,000 tons of coal be compelled to instal, within a limited period, the necessary plant for the production of crude benzole (if this were done there would at once be available a further 30,000,000 gallons of motor spirit annually).

3. That the Government take such steps as will ensure that the output of benzole is available to the public at a reasonable price, and is in no sense controlled by the Shell or Anglo-American Oil Companies.

4. That the Petroleum Executive be asked to consider what further steps can be taken to develop oil production in this country, and how far it may be possible for the larger consumers of coal to carbonise the coal consumed so that all the by-products may be recovered.

5. That facilities be provided for storing, transporting, and retailing power alcohol under regulations similar to those applicable to other types of motor spirit.

6. That the existing restrictions in relation to the installation of storage tanks be reviewed and that there should be a right of appeal to the Minister of Transport in cases where local authorities refuse consent to the installation of such tanks.

The Motor Legislation Committee represents all branches of the motor trade and upwards of 200,000 owners of mechanically-propelled road vehicles. The communication impresses upon the Government the serious effect caused to the industry and to the whole community by the recent increases in petrol prices.

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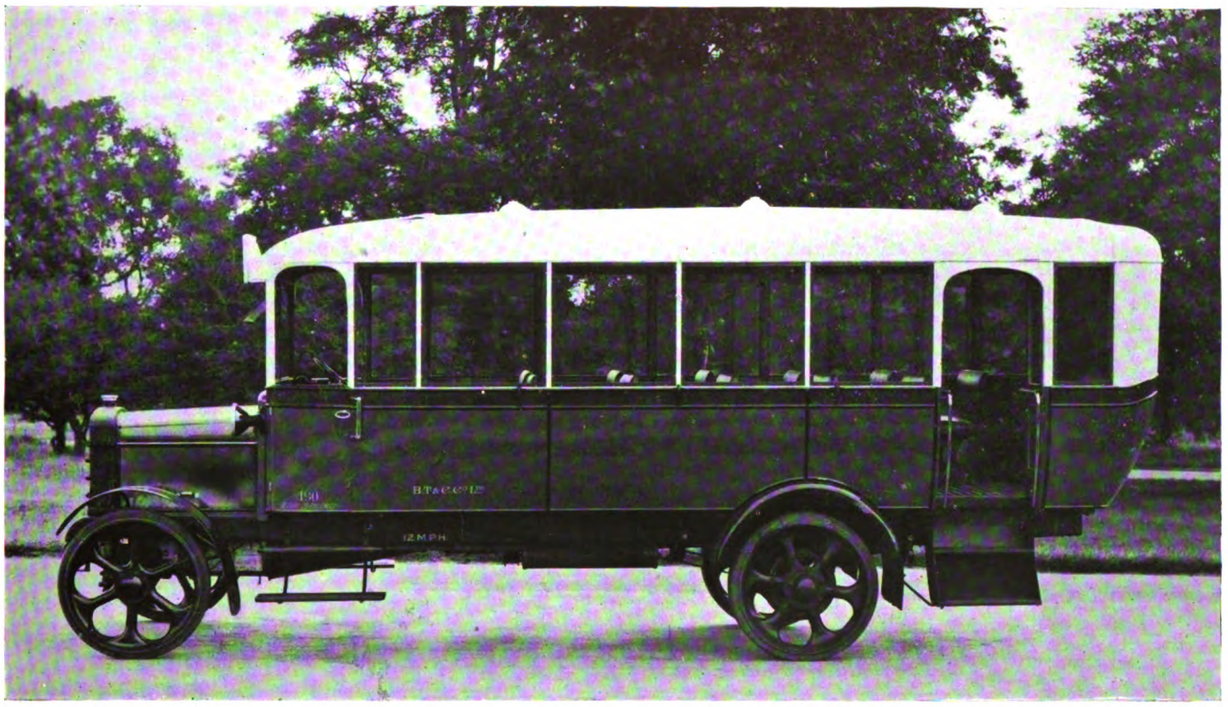
MOTOR TRAFFIC

BRISTOL CHASSIS AND BODIES.

40-H.P. ENGINE ON A 4-TON OMNIBUS AND LORRY CHASSIS.

Lately the Bristol Tramway and Carriage Company, who apparently were the first traction company to produce petrol road vehicles for use in their own service, concurrently with the products of other manufacturers, have placed their 4-ton chassis upon the market. It has the merit of being made for three kinds of service, being suitable for operation as an omnibus, as a coach, or as a lorry. Of its appearance, fitted with an omnibus body weighing 23 cwts., and providing seats for 29 passengers, the reader can judge from the accompanying photograph.

Although light in weight and chaste in design the body is of great strength, which has been arrived at as the result of the company's many years' experience. Owing to the common sense which characterises public vehicle licensing authorities in the provinces, this omnibus is constructed to allow of five persons being seated alongside of the driver. Thus there is some chance of averting the mishaps to omnibus and passengers which might result from a driver being taken ill. There is a separate entrance to the driving seat.



23-Cwt. Bristol Body, Seating 29 Persons.

These Bristol omnibus bodies are notable for having upholstered seats and backs, thus giving the comfort which is more generally associated with the private vehicle. Like the coach bodies constructed by the same company, the omnibus body is built on mass production lines, the management having turned over their aeroplane works mainly to this branch of industry, now more in request. To their aeroplane experience the company owe, in no small measure, their success in producing their vehicle bodies, which are distinguished by greater strength, despite the lessened weight. These improvements are due to the use of welding and of steel plates in lieu of a complete utilisation ofwood. The whole general appearance betokens experience gained in constructing passenger-carrying air machines.

Brief details may be given of the chassis, which weighs 3 tons. The wheel base is 14 ft. 6 in.; the track 6 ft. 1 in.; giving a body space of 18 ft. 5 in. behind the dash. The front tires are single, and the rear are twin. Each axle has ball bearings. The engine has four cylinders, cast in pairs, 4½ bore by 5¾ in. stroke, developing 40 B.H.P. at 1,400 revolutions per minute. The valves are on the near side. Oil is pumped direct to troughs below big ends, by a gear-type pump. Cooling is by thermo-syphon with 3½ in. pipes and spiral tube radiator. A very useful feature is an engine governor mounted in cam-shaft chain wheel, which limits engine speed to 1,400 revolutions per minute. The carburetter is the Claudel-Hobson. Ignition is by Simms high-tension magneto. The lighting dynamo is driven off the magneto shaft. The non-adjustable clutch comprises a single steel plate between two Ferodo lining rings. The drive is by tubular cardan-shaft, with flexible leather joints.

The gear box gives four speeds forward and one reverse, and it also furnishes a mileage recorder. On the rear axle there is overhead worm drive, and fully floating live axles. Ball radial and thrust bearings of large diameter are used in the driving axle. The springs are semi-elliptic, the rear pair receiving the driving torque reaction. Steering is by worm and quadrant, and the control has central gear change and brake levers, the usual pedal controls, the throttle and ignition levers being attached to the steering column. A foot brake works contracting shoes on a drum at the rear of the gear box; the side brake operating expanding shoes in drums attached to the rear wheels. Nickel steel pressings constitute the girder frame and front and rear it is tapered. The cross members are deep, the one in front of the rear wheels being especially so, and having an opening for cardan shaft. Lighting is by a Smith dynamo, the batteries being behind the gear box, and the switches on the dashboard.

OBLIGATORY ROAD SIGNALS.

It is reported that the Committee appointed by the Ministry of Transport, under the chairmanship of Sir T. Borridge, to consider the standardisation of drivers' hand signals, will recommend the adoption of a code based on existing signals. Use of the same will be made obligatory. On vehicles with the left-hand drive, the person in charge will be required to operate a mechanical hand.

Consideration has also been given to the question of imposing a test upon new applicants for driving licences, as is done in France, the United States, and Australia. Sir H. Maybury, the director-general of the road department of the Ministry, has stated that evidence on this point has been heard from Australian and American witnesses, and their testimony speaks well for the system adopted in Sydney and various American cities.

A BRISTOL TRANSPORT SCHEME.—Mr. C. H. Baines, of the Theatre Royal, Bristol, is promoting a scheme for placing a large number of petrol lorries in operation in various towns and districts. It is also intended to develop the use of road vehicles by theatrical companies.

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"PALLADIUM" DEVELOPMENTS.

CANTILEVER SUSPENSION.—NEW STYLE COACHES.

Palladium Autocars, Limited, are to be congratulated on the noteworthy advance in chassis construction shown in their new double-cantilever suspension for heavy commercial vehicles. As the name implies, the springs are only connected to the axle at one end, and this makes possible a much greater range of movement when necessary, giving the designer more freedom in the adjustment of strength and resiliency of spring for any particular purpose. In place of the usual bow springs attached at the centre to the rear axle and carrying the weight of the vehicle on their extremities, this novel and original system employs two particularly powerful springs on each side of the chassis attached at the rear to the axle, at the front to the chassis frame, and supporting the latter by their central portions. The two cantilever springs on each side are placed vertically over one another, and of course have the arched side uppermost. One is fixed immediately above the axle, the other immediately below.

The exact arrangement may be seen in the illustration of a vehicle mounted on the cantilever suspension. As will be noticed, the adoption of the system entails a certain increase in the weight of spring metal; this, however, is of no importance in comparison with the advantage gained by the fact that practically the whole weight of the springs must now be reckoned as sprung weight, whereas in the ordinary arrangement it is unsprung.

A series of demonstrations of the capabilities of the springs on the vehicle shown in the photograph was carried out recently, when a representative of THE TRAMWAY AND RAILWAY WORLD had an opportunity of riding in it. As may be seen, the vehicle is fitted with solid tires, and it carried four tons of ballast as well as eight passengers. Travelling on a road with very bad holes, it was surprising to see what great mobility the springs imparted to the axle while the body remained practically steady. Where the depressions were so serious as to render body movement inevitable, the shock was smoothed out in a most satisfactory manner. In a comparison with an ordinary well-sprung touring car, and allowing for the nature of the seats, there was not much to choose in the question of comfort between the two types. The machine was subsequently taken along the side of a road with the near wheels running over a succession of transverse water gullies that were often more than a foot deep. At a speed of eight or ten miles an hour there was no sensation of jerking; the body rose and fell like a small boat in undulating water, and this analogy was indeed suggested when the motion of the vehicle was observed from the ground. The power and resiliency of the springs were so remarkable that it would be difficult if not impossible to achieve the same results with any other form of suspension for a heavy commercial chassis.

In a great many instances these springs should certainly render unnecessary the expense of pneumatic tires, as the former are themselves as effective as a cushioning device. The increase in cost over the ordinary type of spring is trifling in comparison with this saving, and in any case would be more than repaid by the decrease in maintenance charges consequent on the reduced vibration. In view of the great advantages to be derived from this method of springing, there is little doubt that the Palladium double-cantilever chassis will be widely adopted, at least for large passenger-carrying vehicles.

Palladium Autocars, Limited, are exhibiting at Olympia their standard chassis, for various bodies, as well as a novel form of motor coach now under construction. The following particulars of these exhibits will be of interest. The chassis is of sturdy design, and appears to be of high-class manufacture. The engine is four-cylinder, cast in pairs, 4½ in. bore by 5½ in. stroke, and gives 45 H.P. at 1,500 revolutions; all valves are interchangeable and on the near side, operated by a single camshaft; cast-iron pistons fitted with three rings; crankshaft diameter, 2¾ in.; bearings nickel babbit, backed with bronze; ignition by B.T.H. magneto with impulse starter; carburetter, Zenith, operated by foot accelerator, and hand control on steering column, both independent; lubrication by plunger pumps driven from camshaft; delivery oil direct to main bearings and timing gears, and to troughs under big end bearing; cooling by water pump fan.

Other details of specification are appended. Clutch, dry multiple disc type, universal joints, jaw, and pin type, enclosed in oil-tight casings. Gears, spur type, four forward and reverse, operated through a gate change. Front axle, drop forging of specially treated

Palladium Chassis with Double Cantilever Suspension at Rear Axle.

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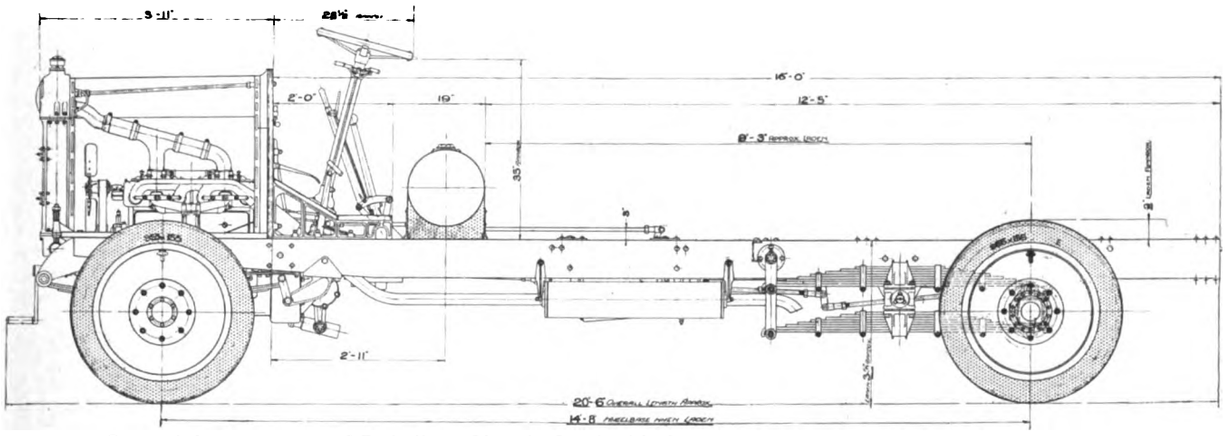
steel; rear axle, full floating type, overhead worm, the whole easily removable for inspection. Foot brake, contracting type, on drum at rear of gear box. Hand brake, internal expanding type on rear wheel drums. Steering-worm and worm-wheel with adjustable ball thrust races. Frame, pressed high tensile steel of channel section, 8 in. deep by 2½ in. wide, braced with cross members. Wheels, hollow spoke cast-steel wheels with British standard rims. Petrol tank, capacity 30 gallons, gravity supply. Chassis dimensions, wheelbase 14 ft. 8 in., track 5 ft. 8 in., overall length 20 ft. 8 in., 24 ft. 8 in. for coach and omnibus bodies, overall width 7 ft. 3 in. Henley's solid rubber tires, 920 by 120 front, 1,050 by 120 twin rear.



General Arrangement of Palladium Chassis fitted with Cantilever Rear Springs and Pneumatic Tires.

Bearings, Timken roller bearings are used on the road wheels, back axle, and gear box.

FOLDING ROOF TO A COACH BODY.

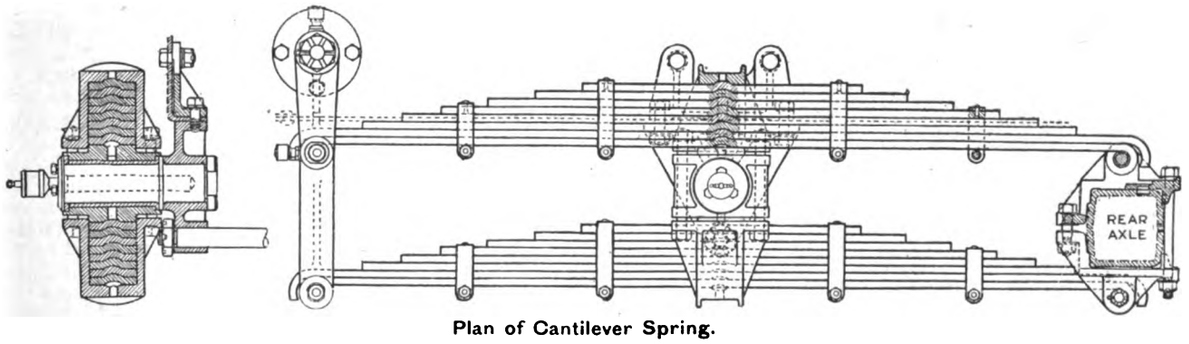
The Palladium folding roof saloon-corridor coach is on a standard chassis, Y.EE2, but with double cantilever springs and Michelin disc detachable wheels with pneumatic tires. Naturally the pneumatic tires, as fitted to their exhibit, should only be kept to a moderate air pressure, and undoubtedly will be a further improvement in comfortable riding. The body is specially designed to combine in itself the advantages of the single-deck motor omnibus and the ordinary motor char-a-bancs, in that it can readily and simply be made a closed or open conveyance by means of its folding roof. An added advantage is obtained by the provision of accommodation for luggage to the extent of an ordinary suit case per passenger. The vehicle conforms in appearance to the single-deck omnibus, the roof being ingeniously folded by a method at once easy, simple, and rattle-proof. The side windows all let down, and are held in position by a special rattle-proof fixing device. All the advantages of the open char-a-bancs are thereby obtained with complete protection from the elements, equal to the closed omnibus, in the event of bad weather.

The interior arrangement of seats is on the saloon corridor plan, slip tables are provided to allow of "pic-nicing" or card playing on long journeys, and illumination is afforded by a series of electric lamps suitably positioned, and supplied from extra large accumulators charged by a dynamo. The aim of the design is to secure ease in converting the vehicle into an open or closed one at will, to do away with the difficulty in putting up the hood of the char-a-bancs, to provide complete protection and comfort to passengers which the hooded char-a-bancs fails to do, and to obviate the stuffiness and confinement of the closed omnibus in fine weather.

CHEAP MID-DAY FARE IN LONDON.

The 2d. mid-day fares on the London tramways and omnibuses have been the subject of correspondence between Lord Ashfield (chairman and managing director of the Underground Companies) and Mr. George H. Hume (late chairman of the Highways Committee of the London County Council). Lord Ashfield, writing from Electric Railway House, Westminster, explains that the introduction of the cheap mid-day fares on the omnibuses is not meant to accentuate competition with the London County Council. The "Underground" Companies think the introduction of the cheap mid-day fares economically unsound, but are making the experiment in order to test their belief in actual practice. Lord Ashfield adds—"If the result of the present experiment should be to show that the 2d. cheap mid-day fare is justified, the companies would have no hesitation in adopting them generally; if they are not justified then we presume the County Council would be open to discuss the question once more upon its merits."

In his reply, Mr. Hume points out that experts differ as to the advantage or otherwise of the mid-day 2d. fare. So far he agrees that from a financial point of view no facts have been officially produced in conclusive support of the policy, and he thinks it would be a great advantage that careful records should be kept by all parties, and that the public should be informed of the facts as soon as definite conclusions can be arrived at.



Plan of Cantilever Spring.

CONTINUATION OF "SUMMER TIME."—The Government announced on Sept. 24 that in view of the then possible coal strike, the return from summer time to Greenwich time, which would normally have taken place at 2 a.m. on the night of Sunday-Monday, shall be postponed. An order in Council will therefore be made, substituting Oct. 25 for Sept. 27 as the date when summer time will end.

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SIR H. MAYBURY IN DEVONSHIRE.

MINISTRY OF TRANSPORT AND THE ROADS.

Sir Henry Maybury, director-general of roads to the Ministry of Transport, addressed the Devonshire County Council Roads Committee, on September 17, on the subject of direct control of the county roads, Devonshire being the only County Council in England which had part of the roads in the hands of Rural District Councils. Mentioning that as from April 1 it was the intention of the Government to subsidise first and second-class roads, main or otherwise, half the cost being paid in one case and 25 per cent. in the other, Sir Henry said the roads to be classified would be primarily main roads. It had been suggested that there was a desire in the department to dictate the policy of the Councils. He would never be a party to such a desire, but he was anxious that Devonshire should fall into line with other County Councils. It would be extremely difficult for the Ministry to deal with all the local authorities, and there were other reasons that emphasised the necessity for administrative purposes of having only one authority in the county. He was sure that, given competent management, they would save three or four times over the expense in official salaries. With an expenditure of £200,000 or £300,000 a year the committee should not hesitate to get the best man to supervise. The Ministry proposed to divide the country into eight divisions, and in each series of counties the department would have a divisional engineer, and any matters that he could not settle with the county or district surveyor would be referred to the Ministry.

COACH TRAFFIC.

Replying to a question, Sir H. Maybury stated that he did not think it was proposed to give control over coaches used for pleasure purposes, but some regulations would no doubt be drawn up to govern traffic upon the roads. He hoped that there would be no parochial legislation to govern this traffic, as it would be difficult, if not impossible, to have regulations in one district which also applied to another. They would not necessarily close a road which could not carry this pleasure traffic, but would endeavour to get the road widened unless the cost were prohibitive. The cost of main road maintenance was a rising one. The average cost on this head last year showed 131 per cent. increase compared with the expenditure of 1914.

At a subsequent meeting of the Council it was decided by a majority of one to take over the roads, provided the Ministry find one-third of the cost and advance the other two-thirds by loan for five years.

A CIRCULAR TO HIGHWAY AUTHORITIES.

In a circular issued to local authorities, Sir Henry Maybury states that if important district roads are scheduled by the Ministry, it is hoped that there will be sufficient justification for such roads being taken over by the County Councils as main roads. If desirable, grants will be made to enable District Councils to so improve roads as to justify the county authorities taking them over. As a general rule the main traffic roads now existing will become first-class roads. All such roads should be at least 20 feet wide.

By-pass roads for fast traffic are contemplated in proximity to big towns. One is now being made for Brentford and another for Croydon. The Ministry does not intend to launch out in any big new road programme, for the simple reason that it has not the funds. A departmental committee is now engaged in drafting regulations with regard to char-a-bancs traffic. The Ministry would rather, if the cost were not prohibitive, have narrow roads widened rather than have them closed to coach traffic.

MUD SPLASH GUARDS.

In consequence of complaints made to the Camberwell Borough Council of mud splashing by licensed vehicles, several inventors of guards have called attention to their patents and contrivances. The Council have invited them to give a demonstration on October 25, at 2 p.m., and have asked the Ministry of Transport and the Commissioner of Police to send representatives. Replying to representations made by the Council, the Ministry of Transport have promised that the point will receive attention from the Departmental Committee on Taxation and Registration of Road Vehicles. The Commissioner of Police replied that he proposed to await the decision of the Ministry.

2d. ALL THE WAY ON OMNIBUSES.

CHALLENGE TO THE LONDON COUNTY COUNCIL.

On Monday, September 27, the London General Omnibus Company instituted twopenny mid-day fares to operate on week-days (Mondays to Fridays, 10 a.m. to 4 p.m., public holidays excepted) between those points on their week-day routes which traverse the London County Council tramway areas. The company states—"The L.G.O.C. only introduce these fares as a measure of self-protection against competition by the L.C.C. trams. The L.G.O.C. will give the cheap mid-day fare a full and open trial in the area covered by the L.C.C. tramways. After the necessary experimental period, the company will publish the figures showing the exact results, in order that the public at large may judge the merits of the policy. They will challenge the L.C.C. to produce their twopenny mid-day traffic figures for comparison."

The innovation has proved very popular with the public, one reason being that the interior of the omnibuses are provided with cushions to the seats.

LORD ASHFIELD'S OFFER TO THE COUNCIL.

Correspondence on the subject of the company's innovation has been issued for publication. Lord Ashfield, chairman and managing director of the allied companies, writing to Mr. G. H. Hume, the leader of the County Council, and ex-chairman of the Highways Committee, states that he wishes to make clear the position of the Underground Companies. "You will understand," he says, "that our compliance with the fares policy of the London County Council in this particular does not spring from any wish on our part to accentuate competition with the London County Council." While it is true that the policy of the companies does not accord with that of the L.C.C., and the introduction of the cheap mid-day fare is considered economically unsound, Lord Ashfield explains that the facts to prove the rightness or otherwise of the policy could not be elicited until all passenger undertakings of the streets had adopted the same practice. If now the experiment should show that the 2d. mid-day fares were justified, the Underground Companies would adopt them generally; if they were shown not to be justified, the L.C.C. would, he presumes, be open once more to discuss the question on its merits.

Mr. Hume's reply welcomes the assurance of Lord Ashfield that there is no wish to accentuate competition, and expresses the opinion that cut-throat competition is not only very harmful to the undertakings concerned, but in the long run detrimental to the public. Experts differed in their views as to the advantage or otherwise of the mid-day 2d. all-the-way fare, and he suggests that careful records of the experiment should be kept by all parties, and the public informed as soon as definite conclusions are arrived at.

MOTOR PARADE AT LIVERPOOL.

The first parade of industrial motor vehicles at Liverpool took place on September 25, under the auspices of the local area of the Commercial Motor Users' Association, when 150 vehicles were adjudicated upon and 250 machines participated in a procession. There were 100 petrol, four electric battery, and 150 steam vehicles. As the latter used either smokeless coal or coke, there was nothing in the nature of smoke nuisance. The awards were as appended—

Electric.—Single Section.—1, Henry Tate and Sons, Limited; 2, J. Blake and Company, Limited.

Petrol.—Single Section.—1, Geo. Wall and Company, Limited; 2, Geo. Wall and Company, Limited; 3, Glover, Hill and Company. Fleets of three.—1, Geo. Wall and Company, Limited (Leyland, Dennis, and A.E.C.); 2, Wm. Ross (two Leylands and an Albion); 3, A. Harding (two Leylands and a Karrier).

Steam.—Single.—1, Fairrie and Company; 2, Fairrie and Company; 3, Pilkington Brothers. Fleet of three.—1, Fairrie and Company (three Leylands); 2, Fairrie and Company (three Sentinels); 3, T. Lawrenson (two Sentinels and a Leyland).

Special merit prizes to drivers for best-kept vehicles.—1, R. Phillips (Geo. Wall and Company); 2, driver of Geo. Wall and Company's steam wagon (name not ascertainable).

Mr. R. Barnett acted as chief marshal, and Mr. J. Harper was chairman of the Organising Committee, whose object in organising the parade was to educate the drivers so that their vehicles, as well as the owners, might benefit. Mr. F. G. Bristow, secretary of the London Association, announced that next year similar parades would be held in Manchester and Preston.

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OMNIBUS SERVICES.

PLYMOUTH.—Residents of Crownhill have petitioned the Corporation to start a regular motor omnibus service between Crownhill and Plymouth.

BLACKBURN.—Next year the Corporation will ask for Parliamentary powers to enable the tramways department to run omnibuses or tramways to Guide.

YARMOUTH.—The Council have purchased three double-decked omnibuses, each holding 34 passengers, from the L.G.O.C., at a cost not exceeding £600 each.

PERTH.—Queues have been adopted by the Corporation for passengers entering omnibuses, posts and chains having been erected to assist the marshalling.

PRESTON.—The Tramways Committee are considering the establishment of an omnibus service, and have asked the engineer to obtain information from other towns.

CARDIFF.—Royal assent has now been given to the Cardiff Corporation Act by which powers are conferred on the Corporation to run motor omnibus and coach services.

COLNE.—A Bill for powers to run omnibuses within and without the borough is to be applied for by the Corporation, on the recommendation of the Tramway Committee.

SOUTH SHIELDS.—The Education Committee, who are opening a school at Cleadon, have asked the Corporation to run a motor omnibus there for the convenience of the children.

MORECAMBE.—The claims of both electric and petrol omnibuses are being considered by the Town Council for a service to be instituted on the sea front in place of the horse tramway cars.

NELSON.—On the recommendation of the tramways manager and the Tramways Committee the Town Council have agreed to promote a Parliamentary Bill for omnibus and tramway powers.

EDINBURGH.—The popularity of the omnibus services run by the Corporation Tramways Department is shown by the traffic returns. In August the weekly number of passengers was about 76,000 on a car mileage of 7,095. Receipts were about £970, or 29·4d. per car-mile.

GLASGOW.—Having had complaints as to the inadequacy of the travelling facilities between Glasgow and Eaglesham, the Glasgow Corporation have asked the tramways manager to report on a suggestion for starting a motor omnibus service from the tramway terminus to Eaglesham.

SOUTHEND.—The Highways Committee have informed the National Omnibus and Transport Company that they will approve of licences being granted for an omnibus service between Victoria Avenue and Chelmsford, subject to the company paying 1½d. per car-mile run upon each journey.

LANARKSHIRE.—Although Glasgow Corporation opposed the application, the Lanarkshire Tramways Company have been granted powers to run omnibuses in extension of the tramways throughout Lanarkshire. The application was enquired into by a Parliamentary Commission appointed by the Scottish Office.

SWANSEA.—At a meeting of Swansea Highways Committee, the South Wales Transport Company applied for permission to run omnibus services on the following routes—Swansea and Cwm districts; Swansea and Dunvant. The town clerk explained the legal position of the matter, and the committee resolved that the applications be acceded to for a period of six months.

WALSALL.—The Ministry of Transport have given consent to the running of motor omnibuses by Walsall Corporation along certain roads in the urban districts of Short Heath and Willenhall and the rural district of Lichfield. The concession is granted for a period of seven years. The Corporation report a loss of £1,613 on their motor omnibuses for the year ended March 31 last. It is proposed to seek powers to raise the charges from the present maximum of 1d. per mile to 2d.

NEWCASTLE-ON-TYNE.—Mr. E. Hatton, general manager of the tramways and motor omnibus services of the Newcastle Corporation, is making preparations for the extension of the omnibus routes in accordance with the powers obtained during last session of Parliament. The new Act gives authority to run anywhere in Northumberland with the consent of the County Council, and in the county of Durham on specified routes. At present the tramways department operates a dozen omnibuses, which are chiefly the Tilling-Stevens petrol electric type. In the near future the general manager intends to put from 20 to 30 additional vehicles on the roads, using various makes, the intention of the department being to thoroughly test various types.

THE COMMERCIAL VEHICLE EXHIBITION.

Under the auspices of the Society of Motor Manufacturers and Traders, the Exhibition of Commercial and Industrial Vehicles is being revived at Olympia, October 14-23. The show is the first that has been held since 1913, and in the interval the motor vehicle has been through war experience in many climes that will require several volumes to do justice to the part it played towards winning the war. Evidence of the great strides which the industry has made as the result of the war is shown by an exhibition that eclipses all records for the number of exhibitors and exhibits. In this issue it is impossible to do more than give the names of the seventy-odd firms exhibiting in the vehicle section, and a few others—

Albion Motor Car Company.
Alldays and Onions.
Ancona Motor Company.
Associated Equipment Company.
Austin Motor Company.
Auto-Carriers.
Beardmore, Wm., and Company.
Belsize Motors.
Bramco.
Brasier, Société des Automobiles.
Bristol Tramways and Carriage Company.
British American Import Company.
British Berna Motor Lorries.
Browne, F. G. R.
Burford, H. G., and Company.
Caledon Motors.
Clayton Waggons.
Commercial Cars.
Daimler Company.
De Dion Bouton.
Delaunay-Belleville Automobiles (England).
Dennis Brothers.
Dennis Portland.
Du Cros, W. and G.
Durham Churchill and Company.
Fiat Motors.
Fodens.
Garrett, Richard, and Sons.
Gaston.
Gaunt, W. C., Company.
General Motors.
General Vehicle Company.
Gnapp, G. Cecil, and Company.
Guy Motors.
Hall, J. and E.
Halley's Industrial Motors.
International Harvester
Karrier Motors.
Leyland Motors.
London and Midland Motors.
McCurd Lorry Manufacturing Company.
Mann's Patent Steam Cart and Wagon Company.
Maudslay Motor Company.
Maxwell Motors.
Melchior, Armstrong, and Dessau.
Newton Brothers (Derby).
North Western Motors.
Palladium Autocars.
Panhard and Levassor.
Ransomes, Sims and Jefferies.
Rawlence, L. C., and Company.
Renault.
Robey and Company.
Saurer, Adolphe, Société, Anonyme.
Scammell, G., and Nephew.
Seabrook Brothers.
Sentinel Wagon Works (1920).
Star Engineering Company.
Straker-Squire.
Tasker, W., and Sons.
Thornycroft, J. I., and Company.
Tilling-Stevens Motors.
Unic Motors.
Vinot Cars.
Vulcan Motor and Engineering Company (1906).
Walker Brothers (Wigan).
Wallis and Stevens.
Whiting.
Willys-Overland.
Yorkshire Commercial Motor

In the bodywork section exhibitors are—

Bartle, James, and Company.
Bauly, H. C.
Bayleys.
Beadle, J. C.
Bonallack and Sons.
Bristol Wagon and Carriage Works Company.
Dodson, C.
Fry Brothers.
Hora, E. and H.
Liversidge, J. and Son.
Morgan and Company.
Robson, W. and T.
Thorn, W. and F.
Vincent, William.

The accessories and component section had over 78 exhibitors, and the tire and wheel section was represented by the following firms, namely—

Avon India Rubber Company.
Bates, W. and A.
Bergougnan Tyre Company.
Connolly, J. W. and T.
De Nevers Rubber Tyre Company.
Dunlop Rubber Company.
Goodrich, B. F., Company.
Goodyear Tyre and Rubber Company (Great Britain).
Henley's Tyre and Rubber Company.
Macintosh and Company.
Michelin Tyre Company.
Midland Rubber Tyre Company.
North British Rubber Company.
Pirelli.
St. Helens Cable and Rubber Company.
Shrewsbury, S. T., and Challiner Tyre Company.
Spencer, G., Moulton and Company.
United States Rubber Company
Wood-Milne.

An illustrated description of the exhibits will be given in THE TRAMWAY AND RAILWAY WORLD next month.

LEFT-HAND DRIVE DANGER.—At an inquest held on September 23, on a man who died from injuries received from being crushed between a motor lorry and a tramway car in Westminster Bridge Road, the driver of the lorry said it was an American car. He considered he had plenty of room to pass between the tramcar and another vehicle, although there was only twelve inches to spare. He was following other traffic. The Lambeth coroner, Mr. S. Ingleby Oddie, said that the accident had arisen through the left-hand drive, which was not at all suitable for the London Streets.

FOREIGN PETROL PRICES.—A telegram from the New York correspondent of the *Times* stated that the retail price of petrol there varies from 1s. 10d. to 2s. per gallon. In Toronto the price is just over 2s. 4d. at the present rate of exchange. From this it appears that the current retail prices for petrol in other countries do not bear out the contention that the present price in this country is inevitable. In France the price varies from 4s. 4d. to 5s. 4d. per gallon, while Madrid has to pay 4s. 6d., and in Rotterdam the price is now only 3s 4½d., or 11d. a gallon less than in England.

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EMPIRE MOTOR FUELS COMMITTEE.

DEVELOPMENT OF ALCOHOL FUEL.

The Empire Motor Fuels Committee of the Imperial Motor Transport Council is dealing actively with the general conditions underlying production and development of alcohol for power and industrial purposes. It has recently appointed a small expert committee to deal with—

(*a*) The modification of customs and excise restrictions in connection with alcohol.
(*b*) By means of experiments, the best conditions for developing the alcohol engine and types of alcohol fuels—alone or in mixture—for the purpose; and
(*c*) The very important subject of denaturation (or rendering alcohol unpotable).

Good progress is being made with the work of all three committees, but it is felt that members of the public who may have given special attention to the question of denaturation of alcohol should be invited to forward any suggestions for confidential examination and report by the Denaturation Committee. Any such communications should be addressed to Sir Charles Bedford, LL.D, D.Sc., Empire Motor Fuels Committee, 50, Pall Mall, London, S.W.1, marked "Denaturation," and will be treated as strictly confidential. Any suggestions which may prove practicable will remain the sole property of the proposer. It is essential that any proposals regarding denaturents should be made with the knowledge of the particular requirements of a satisfactory denaturant, viz.—

(*a*) Deterrent taste and smell.
(*b*) Non-poisonous.
(*c*) Must not be removable at a commercial cost.
(*d*) Must be readily detectable in small quantities.
(*e*) Must be readily mixable with the spirit; and
(*f*) Must be inexpensive.

It is, of course, exceedingly difficult to obtain any one substance which will conform to all these requirements, but the difficulty in practice has usually been overcome by using a combination of substances whose complementary action meets the requirements. It is inevitable that many suggestions will be made which fail to meet these requirements, but the committee believes that a successful object will be attained by letting those interested know that there exists a small expert body, acting solely in the public interests, which is prepared to examine confidentially any proposals regarding denaturants. In the event of any such suggestions proving workable, the inventor would be communicated with and his interests fully safeguarded before the committee proceeds to communicate the results to the Empire Governments concerned.

ELECTRIC WELDING.

The Alloy Welding Processes, Limited, 16, Cockspur Street, S.W.1, had a most interesting exhibit at the Machine Tool and Engineering Exhibition at Olympia. Demonstrations were given daily at stated intervals, and every endeavour was made to satisfy the large number of engineers who visited the stand as to the practicability and the many advantages of the A. W. P. system of electric welding. Included in the exhibit, and shown in actual use, was a single unit motor generator welding set. The generator, specially designed for welding, has characteristics of efficiency which make it one of the smallest and most economical welding sets on the market. The motor is only 7·5 H.P., a point of considerable importance now that power costs have increased to such an extent as to form a large proportion of the total working costs. The plant shown was designed for D.C. supply especially suitable for tramway and light railway use where D.C. supply is readily available. Mounted on a suitable truck and connected to a trolley wire or third rail, the whole plant is very portable, and owing to its light weight can be easily moved from place to place.

Demonstrations of special interest to all users of machine tools were those in which a deposit of high speed steel was welded to tool tips. This is one of the latest applications of the A. W. P. system and is obviously of the greatest importance to the machine tool industry.

A TRAFFIC SUGGESTION.—It is suggested by the Camberwell Council that there should be a stringent regulation that omnibus stopping places should be at least 30 yards in the rear of tramway stopping places.

MOTOR VEHICLES FOR MUNICIPALITIES.

SUTTON URBAN COUNCIL have decided to purchase a motor fire engine.

WALSALL WORKS COMMITTEE recommend the purchase of three motor lorries.

GOOLE COUNCIL propose to spend £1,800 on the purchase of motor vehicles.

STOCKTON-ON-TEES CORPORATION are borrowing £835 for the purchase of a wagon.

LIVERPOOL WATCH COMMITTEE have authorised the chief constable to purchase a motor van.

WORCESTER COUNCIL are purchasing a steam roller and motor wagon at a cost of £1,826.

PETERHEAD COUNCIL propose to raise a loan of £1,370 for purchasing a steam wagon.

RUISLIP COUNCIL have received sanction to borrow £950 for the purchase of an Albion lorry.

EDMONTON COUNCIL have ordered two 5-ton Orwell electric wagons for refuse collection.

ASHTON-UNDER-LYNE COUNCIL are borrowing £1,450 for the purchase of a motor fire engine.

KINGSTON-UPON-HULL COUNCIL are borrowing £1,985 for the purchase of a motor fire engine.

MANCHESTER GAS COMMITTEE have arranged to purchase two 5-ton Sentinel steam end-tipping wagons.

SHEFFIELD CORPORATION have received sanction to borrowing £62,000 for the purchase of electric tipping wagons, etc.

LAMBETH CLEANSING COMMITTEE propose to purchase the latest pattern sweeping machine from the Lacre Motor Car Company, Limited.

BRADFORD CLEANSING SUPERINTENDENT reports that the last of three Lacre street sweeping machines which were on order has been delivered.

LEEDS CLEANSING COMMITTEE have authorised the chairman and deputy chairman to purchase a motor vehicle for use in connection with the farms.

PRESTON CORPORATION propose to purchase a 5-ton steam wagon at a cost of £1,410. A motor van is to be obtained by the Health Committee to replace two-horsed disinfecting vans.

LEICESTER CORPORATION have been informed by the cleansing superintendent that he is convinced the street watering could be done more efficiently and cheaper if motor vehicles were employed.

NEWPORT CORPORATION have obtained five 3½-ton "Orwell" tipping wagons from Ransomes, Sims and Jefferies, of Ipswich. These vehicles have Exide batteries, and the electrical equipment includes two compound-wound motors, each of which develops from 3½ to 8½ B.H.P.

GLASGOW GARAGE COMMITTEE are considering offers for the supply of a car for the Lord Provost. A combined watering and sweeping machine, purchased from the Lacre Motor Company, has been put into service. Six of these appliances have been ordered by the Corporation.

BOLTON CLEANSING COMMITTEE have appointed a sub-committee to visit Rochdale to inspect a gully emptying wagon belonging to the Corporation, with power to purchase such a vehicle. The Streets Committee have decided to purchase a Straker-Squire 3½-ton tipping wagon.

PLYMOUTH TOWN COUNCIL have been notified by Messrs. Straker-Squire, Limited, that owing to the increased cost of labour and material generally, the cost of the motor vacuum gully cleanser would be increased by £100 - from £1,350 to £1,450. The Council have agreed to pay the extra amount.

WALTHAMSTOW URBAN COUNCIL are raising a loan of £1,975 for the purchase of steam wagons. The surveyor having been unable to purchase a second-hand one-ton lorry, he has purchased a Ford chassis, for which a body is being constructed in the Council's workshops. The Ministry of Health have sanctioned the borrowing of £5,025 for the purchase of six steam wagons.

AT THE MINISTRY OF HEALTH INQUIRY into the application of Swansea Corporation to borrow £14,000 for steam wagons and trailers, &c., the borough engineer stated that he had approached the Ministry of Transport with a view to obtaining a grant towards the cost of providing these vehicles. As a result, the Ministry had definately promised to make a grant of £4,800 towards the cost of purchasing the vehicles, and this grant, which works out at one-third the total cost, will be paid in instalments as the vehicles are purchased.

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Members of the Municipal Tramways Association en route from Weston-super-Mare to Cheddar in Handsome Motor Coaches, Built by the Bristol Tramways & Carriage Co. Ltd.

MAIDSTONE WORKS OF TILLING-STEVENS.

In order formally to inaugurate their new works at Maidstone, the directors of Tilling-Stevens Motors, Limited, entertained a number of their shareholders and friends at the works on Tuesday, September 28, when the well-arranged plant, together with the system of working, was explained to them. Presiding at luncheon in the spacious dining hall of the company's Maidstone institute, Mr. Walter Wolsey clearly outlined the company's policy when he said that they did not go in for mass production, but, believing that they had one of the finest chassis procurable, desired to supply in the most efficient manner the demand which had been created as a result of its proved excellence.

The new buildings are fine examples of modern shop construction. Of ferro-concrete, they are specially designed to secure efficient production under hygienic conditions, and comprise a five-storied central main block with side buildings at the river-side, giving a total floor space of over 190,000 sq. ft. A well-equipped wharf on the river Medway and a private siding from the adjacent railway render the question of transport extremely simple.

Much interest was shown in the company's exhibit which was being prepared for the commercial vehicle show at Olympia, especially in the 50-H.P. bare chassis, which is expected to withstand the most critical examination.

MOTOR TRAFFIC NOTES.

REDUCTION IN THE PRICE OF PETROL.—In consequence of the fall in the price of petrol that has taken place in America, the Shell Marketing Company on October 11 announced a reduction in the retail price of petrol of 3d. per gallon. The Anglo-American Oil Company have likewise reduced the price of Pratt's spirit and Anglo-taxibus spirit by 3d. per gallon.

MOTOR FUEL FROM STRAW.—American Government scientists are experimenting with motor fuel produced from ordinary straw at Arlington, near Washington.

IMPRESSMENT OF COMMERCIAL VEHICLES.—In order to provide for food distribution in the event of a strike, the Government have planned to impress commercial vehicles on a very extensive scale.

COST OF PETROL.—Mr. F. E. Powell, chairman of the Anglo-American Oil Company, asserts that Great Britain is receiving the finest motor spirit produced at a price which is relatively the lowest in the world.

GRANTS FOR STEAM ROLLERS.—In cases where it is considered advantageous, the Ministry of Transport is making grants to cover the cost of the purchase of steam rollers and other plant from the Road Improvement Fund.

CABS WITHDRAWN AT GLOUCESTER.—Owing to the refusal of the City Council to permit the charging of fares approximately 100 per cent. over the pre-war scale, the Bristol Tramways and Carriage Company havewithdrawn their motor cabs from Gloucester.

BRIGHTON ASKS FOR PNEUMATIC-TIRED OMNIBUSES.—Brighton Watch Committee asked Messrs. Tilling, Limited, to fit pneumatic tires on omnibuses to obviate complaints on one of the routes of noise and vibration. Messrs. Tilling replied that the provision of pneumatic tires is impossible, even if the expense were justified by the traffic on the service.

COVERS FOR OMNIBUS SEATS.—A request having been made that the Ministry of Transport should make a regulation requiring the provision of covers to top deck seats on omnibuses, the Ministry have replied that the matter would appear to be one for the licensing authority to deal with. The question was receiving the attention of the Commissioner of Police.

A TRAFFIC CENSUS.—In accordance with the instruction of the Ministry of Transport, the Stretford Urban Council took a census of vehicular traffic on Trafford Park Road for the period from August 11 to 17 inclusive, with the following result—bicycles 9,693, motor vehicles 6,721, horse-drawn vehicles 3,225, tramway cars 1,584, cattle 186, hand-carts 248, horses drawing vehicles 3,452; total, 25,110.

WAR PERIOD CHARGES NOT TO BE CONTINUED.—In reply to a letter from *Motor Traction* the Ministry of Transport have stated that it is open to motor omnibus undertakings to apply for a revision of the Ministry's Award of payments to local authorities under the Local Government (Emergency) Act, 1916. The revision will be as from January 1, 1920, when the new scale of vehicle taxation comes into operation.

HOUSING AND HAULAGE.—In a circular to local authorities the Minister of Transport requests that the Council's surveyor may be permitted to advise as to the best means of transporting the necessary building materials for housing schemes in order that road

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MOTOR TRAFFIC

damage may be reduced to a minimum, and also to inspect and report upon the condition of the roads to be used before the housing traffic is put upon them.

DOUBLE DECK OMNIBUSES AT HULL.—Members of Hull Corporation Tramways Committee have made trial trips on a double deck motor omnibus which the committee has selected for the proposed Stoneferry service. The tramway manager estimates a deficit on the scheme of between £7,000 and £8,000, but it is felt that the need for transport is so great that the Corporation is justified in instituting the service.

A.E.C. Standard 4-Ton 45-h.p. Chassis.
With Giant Pneumatic Tires (Rear Tires 9 in. and Front 8 in. section)

MOTOR OMNIBUSES FOR NEW HOUSING ESTATES.—Ilford Council have asked the Minister of Transport to receive a deputation with reference to the position of local authorities desiring to purchase and run motor omnibuses in order to provide travelling facilities in connection with the State-aided housing schemes. Ilford Tramways Committee have asked the tramways manager to obtain quotations for a 3-ton electric or petrol lorry.

BRITISH OIL PRODUCTION.—The Rt. Hon. F. G. Kellaway, M.P., Parliamentary Secretary of the Department of Overseas Trade, states that the annual oil production of the Empire is less than 2,000,000 tons, while the annual consumption is 6,000,000 tons. There are some grounds for hoping that the oil fields of Britain may yet prove valuable as the result of the borings which are being continued under the auspices of the Government.

with the restrictions imposed by the Council. It was decided to consider the matter if the applicant submitted a definite proposal.

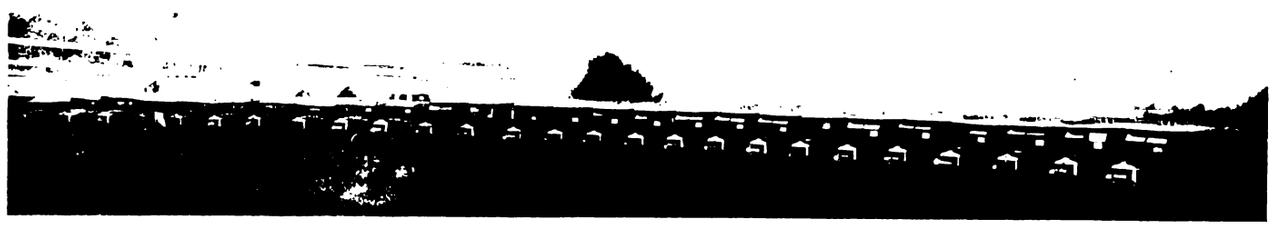
COMMERCIAL AVIATION IN THE UNITED STATES shows a steadily growing popularity, says the Manufacturers' Aircraft Association. The airplane is undergoing the same development experienced by other vehicles of transportation introduced to the public, and at present there are fifteen manufacturers of aircraft and aircraft motors and eighty-five manufacturers of accessories. During the past few months twenty new airplane distributing agencies have been established.

OBJECT OF THE TRAFFIC CENSUS.—Under the new scheme of road maintenance, the Government will pay to the local authorities 50 per cent. of the cost of maintenance of first-class roads and 25 per cent. in the case of second-class roads. In order that the Ministry of Transport may satisfactorily adjudicate upon the claims for classification, the local authorities are required to take a census of the traffic, the expense of this work forming part of the costs of the application for classification.

LONDON'S FIRST PRISON VAN.—Those most unprogressive State departments, the Home Office and the Prison Commissioners, have at last introduced motor traction into the London prison service, years after its adoption in the provinces. Prisoners are now conveyed to and from Brixton prison and the police courts in light and speedy vans, which are an immense improvement on the old pair-horse, high "Black Marias." These vehicles were a public danger when entering a main road from a side street.

THE NEW LONDON OMNIBUS FARES.—The London General Omnibus Company state that the scale adopted for their new fares is—Up to two stages, 1½d.; three stages, 2d.; five stages, 3d.; seven stages, 4d.; advancing 1d. for each additional two stages. By arrangement with the L.C.C. this scale has been modified in the L.C.C. tramway area, so as to provide for a charge of 1d. for one stage, and for 4d. fares covering more than seven stages. The average length of an omnibus stage is approximately 0·6 miles. On the outlying country routes, where the traffic is light, a higher scale of fares is in operation.

RESTRICTING RUBBER PRODUCTION. The Council of the Rubber Growers' Association, at a meeting held in London on September 24, unanimously decided to recommend to all producers of plantation rubber that a genuine reduction of 25 per cent. of the estimated normal monthly output should forthwith be brought about by each estate by modification of its existing tapping system. A report presented at the meeting stated that if production continues at the present rate there will be a surplus of anything from 35,000 to 40,000 tons of rubber to be taken care of at the end of 1920, and unless the world trade conditions materially alter for the better within a few months this surplus will be further augmented during 1921.



Associated Equipment Company's Vehicles of the Great Western Railway Used for Ascot Races.

COMMERCIAL VEHICLE SHOW AT TORONTO.—The Albion Motor Car Company, Commercial Cars, Limited, Leyland Motors, Limited, and the Vulcan Motor and Engineering Company were among the exhibitors at the annual show of motor vehicles recently held at Toronto. As the City Council is considering a scheme or operating omnibuses, the Leyland Company offered the use of two such vehicles free of charge as an experiment.

IS THE HAULAGE BUSINESS OVERDONE?—Barnes Urban Council have been asked by a motor transport proprietor to allow him to use his garage for other purposes. Owing to the price of petrol and the haulage business being overdone, his motor business was finished and he found it impossible to sell the premises

MOTOR COACH QUESTIONS.—Replying to a question, the Parliamentary Secretary of the Ministry of Transport stated that there was no legal limit to the number of people which could be carried in a char-a-banc provided the vehicles complied with the Motor Car Act and the regulations made thereunder. Such of these vehicles, however, as ply for hire in the Metropolitan Police Area, in provincial cities and towns, and urban districts were licensed to carry such number of passengers only as the licensing authority considered to be safe. The Departmental Committee inquiring into the question of coach traffic would take into consideration the question of the use of motor lorries for passenger transport, for which work the vehicles were never intended.

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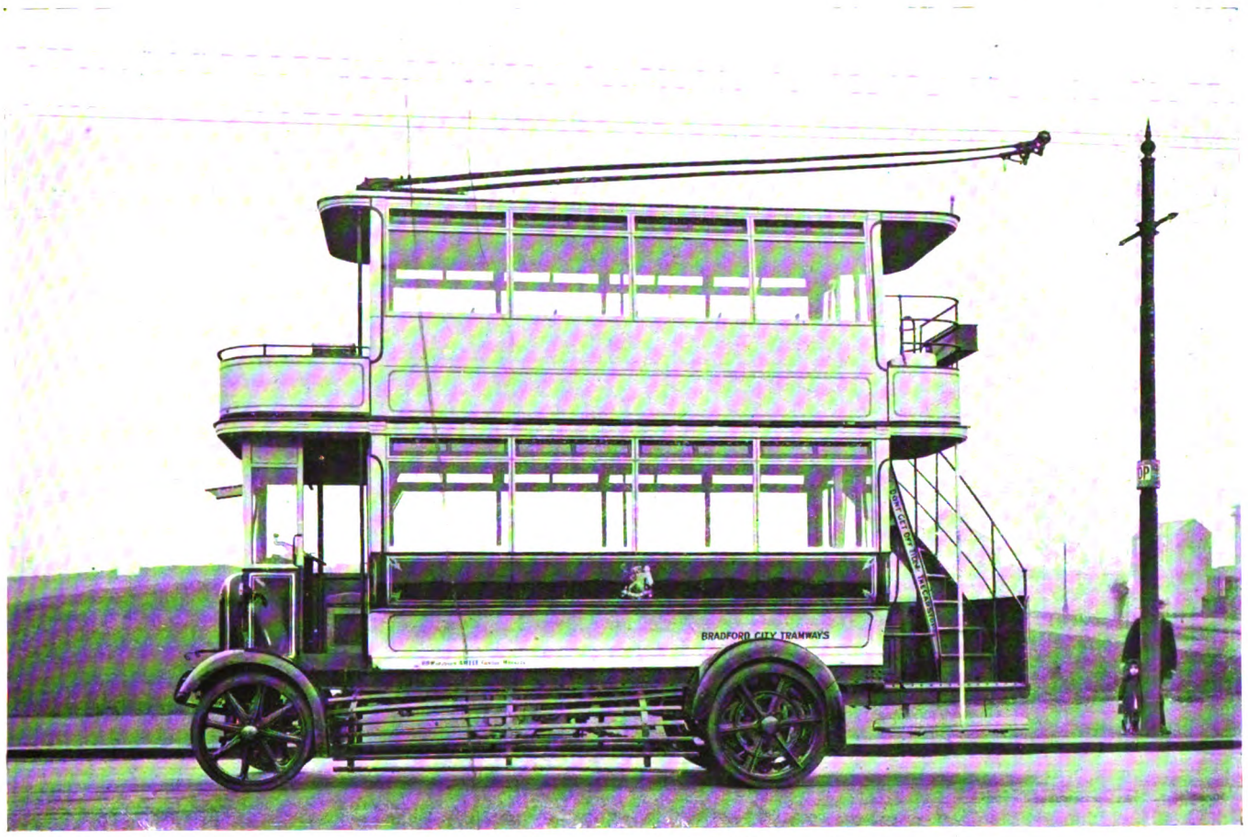
THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

Founded 1892. LONDON, NOVEMBER 18, 1920. VOL. XLVIII.

BRADFORD CORPORATION DOUBLE-DECK RAILLESS CAR.

A NOVEL TYPE OF VEHICLE CAPABLE OF RUNNING ON TRAMWAY OR RAILLESS ROUTES.

In February last Mr. R. H. Wilkinson, general manager of Bradford Corporation Tramways, submitted to the Tramways Committee a design for a railless car with enclosed top deck. Subsequently application was made to the Ministry of Transport for permission to use a vehicle constructed in accordance with the designs, and this was granted. The first car of the type was recently completed at the Thornbury works of the Corporation, and on November 3 it underwent its trials very successfully.



The First Double-Deck Railless Car.—Bradford Corporation Tramways.

The car seats 51 passengers, 26 being accommodated on the upper deck. It is driven by one 45 H.P. tramway motor mounted on the chassis frame, driving the back axle by a chain. Without load the weight is about five tons. The extreme width of the car is 7 ft. 10 in., and the wheel base 13 ft. The sides taper toward the roof, which not only gives a good effect but avoids the danger of collision when a sharp curve in the road would cause a wider roof to overhang. Rubber tired wheels and well sprung seats are provided.

While intended primarily for railless routes, the car can be run from the ordinary tramway trolley wires along the tramway track. When this is done one of the two trolleys usually required for the railless system is lowered and fastened down, and the current is taken from one trolley, contact with the permanent way being effected by fixing an iron shoe to the front of the car. This shoe fits the groove of the rail, and is connected by a short rod to the steering axle of the car. It thus serves to steer the car automatically and to provide the necessary earth contact.

In an article published in our issue of July 15, 1920, dealing with the possibilities of railless electric traction, Mr. Wilkinson said that in Bradford the working costs

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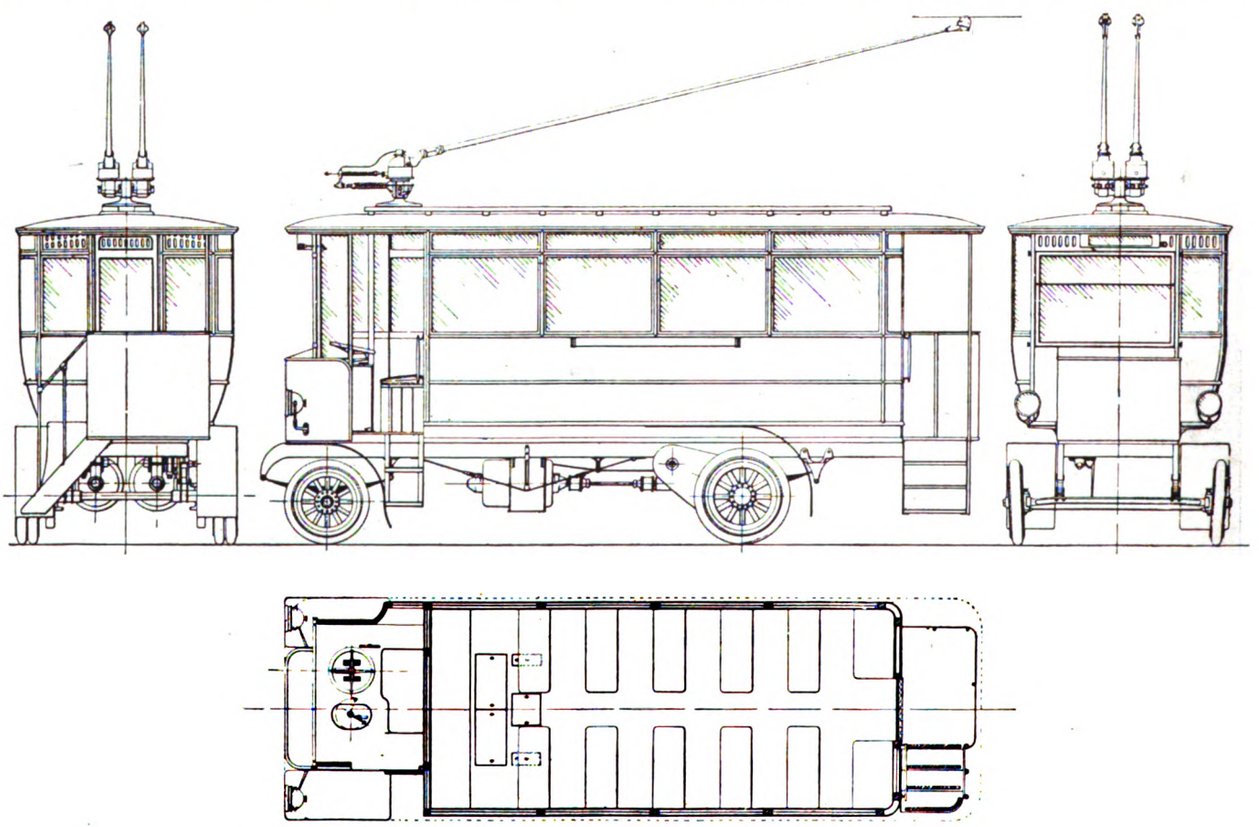
of railless cars were higher than they would be with properly constructed vehicles, but nevertheless they were approximately 4d. per mile less than those of the tramcar. With the new double-deck vehicle the working costs will probably be slightly more than those of a tramcar, but the capital cost of a railless line is, of course, very much less than that of a tramway. The cost of one mile of double tramway track to-day would be at least £40,000. Mr. Wilkinson has previously stated that he considers the railless vehicle to be the more economical up to approximately a five minutes' service on a single and a three minutes' service on a double line tramway. The new vehicle is not considered a competitor of the motor omnibus, the latter being probably the more economical where a service of about an hour or longer period is required.

Satisfactory as the new vehicle appears, Mr. Wilkinson has in view the introduction of important improvements, which he hopes to embody in the near future. He points out that beside the relative economy of the railless cars, they possess certain advantages over tramways. A vehicle breaking down does not interfere with or cause any delay to other vehicles in service; they can draw closer to the sidewalk for loading and unloading, and they make considerably less noise than a tramcar, and offer greater facilities for inter-running arrangements.

Railless cars have been in regular service in Bradford and Leeds since early in 1911, but the new car differs largely from any that have hitherto been constructed. Full particulars, with many photographic views and descriptions then given will provide interesting comparisons. For the convenience of present readers a drawings, will be found in the volume of this journal for the first half of the year just mentioned, and the drawing of one of the original Bradford railless cars is here reproduced, together with the designs of Mr. Wilkinson's new railless car, which is repeated from our issue of February last, that issue being now out of print. We take this opportunity to thank Mr. Wilkinson for the drawings and photographs of the car which he has kindly supplied for this article, and to congratulate him on the courage and skill with which he has dealt with a problem of no little difficulty.

Front and Side View of the New Railless Car.



Elevation and Plan of Railless Car put in Service in Bradford in 1911.

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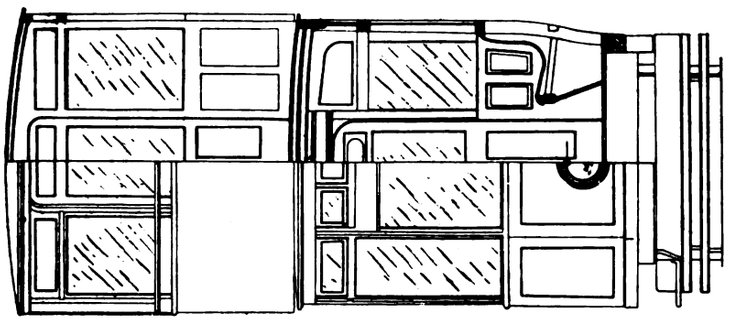
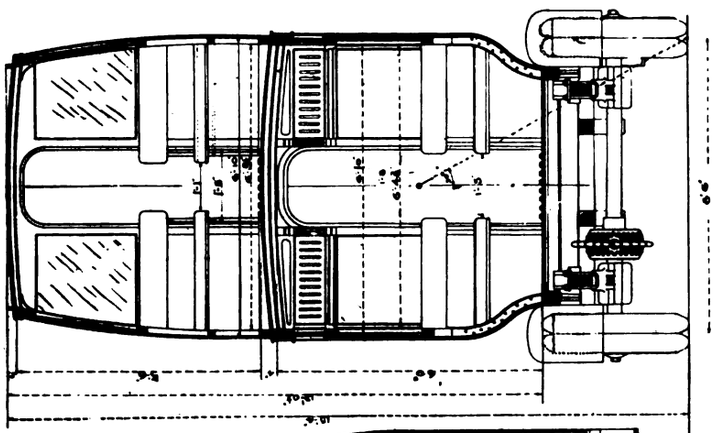
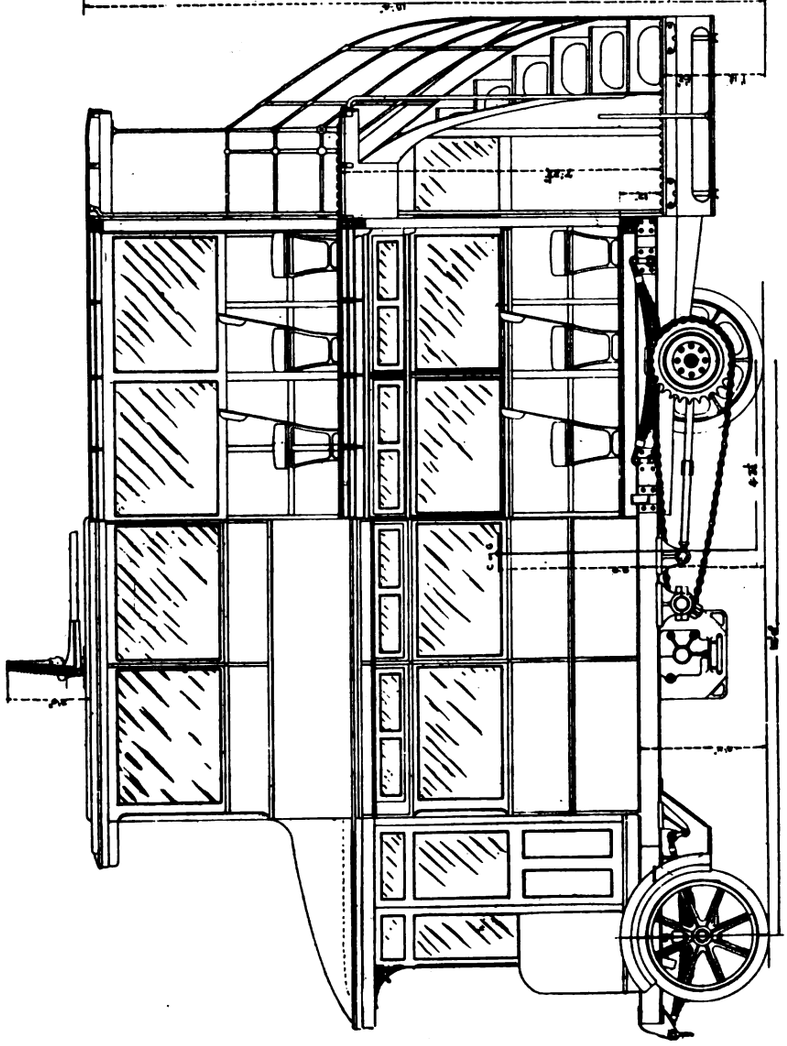


End Elevation and Half Section of a Top-Covered Tramway Car.

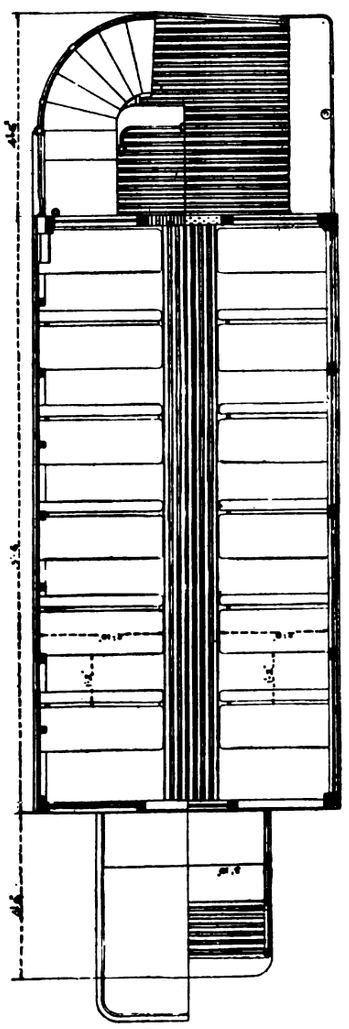


Cross Section.



Side Elevation and Half Section.

The Double-Deck Railless Car, Designed by Mr. R. H. Wilkinson, General Manager, Bradford Corporation Tramways.



Plan.

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TRAINING OF DRIVERS AND GUARDS ON MANCHESTER CORPORATION TRAMWAYS.

Applicants for situations as drivers and guards on Manchester Corporation Tramways are interviewed daily by the traffic superintendent. Those who are considered suitable are given a form (A) to fill up, and these forms are filed for future reference. When men are required a selection is made of the most suitable applicants, and a post-card (Form B) is sent to each man asking him to call upon the traffic superintendent. He is then told the conditions of employment, and if these are agreeable to him full inquiries are made by means of printed forms as to his character from his previous employers during the past five years. If the answers are satisfactory (Form C) he is examined by the department's doctor, who reports as to his physical fitness, eyesight, etc. (Form D). If the report is favourable the man is engaged and sent to the school to be trained by the instructor.

The school is a large room at Queen's Road depot, and is fitted up with a skeleton car mounted on a truck. Every part of this car is exposed to view or is easily accessible, and shows the motors, controllers, trucks, lighting and bell circuits, etc. On the skeleton car are photographs showing the right and wrong positions for ringing off a car. The former shows the guard looking into the street and consequently on the look out for passengers, and the latter shows him looking into the car, and therefore unable to see any intending passengers who may be approaching. Another photograph shows a lounging attitude on the car, and its companion shows how to stand upright and alert on the platform.

On one side of the school there is a raised platform (called the "practice" platform), on which is fitted dash rails, controllers, brakes, sand pedals, and gongs. A dozen men can be instructed on this platform at one time. There is also a blackboard showing in red lines the wiring of a car and the path the current takes from the trolley wire to the rail. There is ample seating accommodation for the men whilst receiving lectures from the instructor.

A driver is first instructed briefly in the duties of a guard, and is then put to work for a few days with an experienced guard on the "training" route. This "training" route is a typical route which extends from one side of the city to the other, and is selected because it is one which is likely to give the learner a good experience in the duties of a guard, particularly as regards loading at the rush hours, trolleying a car, etc. After a few days' training he works as a guard on this route for a month, for which he receives the usual rate of pay. At the end of this period he re-enters the school and is then instructed in all the details of the car equipment, including motors, controllers, brakes, sand gear, etc. He is then put on the "practice" platform, where he learns how to strike notches properly, apply the brakes, how to stand when driving, etc. He is then instructed on all the various points connected with the duties of a driver, such as how to avoid wasting current, the damage caused by

J. M. McELROY,
GENERAL MANAGER

TELEPHONE No 7800 CITY TELEGRAMS TRAMWAYS, MANCHESTER

MANCHESTER CORPORATION TRAMWAYS

GENERAL OFFICES, 55, PICCADILLY,

[2599] MANCHESTER. *Date as postmark*

Dear Sir

Please call at this Office on _____ next, at _____ to see our Traffic Superintendent (Mr. Oakes) respecting your application for employment, and bring this note, your birth certificate, and army papers with you

Yours truly,
J. M. McELROY,
General Manager.

(FORM B.)

Manchester Corporation Tramways.

Form to be filled up (in their own handwriting) by applicants for situations.

Application for situation of*_____
Full Name_____
Address _____
Age_____
Height_____ft._____in.
Married or Single_____

Employer or Employers during the past five years		Nature of Employment	Dates between which Employed		Reason for Leaving
Name	Address		From	To	

Particulars of Army Service
Have you ever been employed on any other Tramways? If so, when, where, and how long? _____
Are your eyesight and health good?_____
Signature of Applicant_____
Date_____

* *State here—*
(*a*) *Driver.*
(*b*) Guard.

N.B.—No one need apply unless of strictly temperate habits.

If you are not sent for within three months, this application should be renewed.

(FORM A.)

Private and Confidential.

Manchester Corporation Tramways.

General Manager's Office,
55, Piccadilly, Manchester,_____19____

Sir,

_____who states he has been in your employ from_____ to_____has applied to this department for a situation, and refers me to you as to his character, etc. Will you kindly return this form as soon as convenient, with your replies to the several questions given below?

Yours faithfully,
J. M. McELROY, General Manager.

_____
_____
_____

How long have you known the above-named person? _____
Have you ever employed him; if so, how long and in what capacity? ... ... _____
Was he uniformly sober, industrious, and attentive? _____
Have you ever known him guilty of any act of dishonesty or irregularity of conduct? ... ... _____
When did he leave your service? ... ... _____
Why did he leave your service? ... ... _____
Do you know any reason why he should not be employed by this Corporation? ... ... _____

Signature_____

A stamped envelope enclosed for reply.

(FORM C.)

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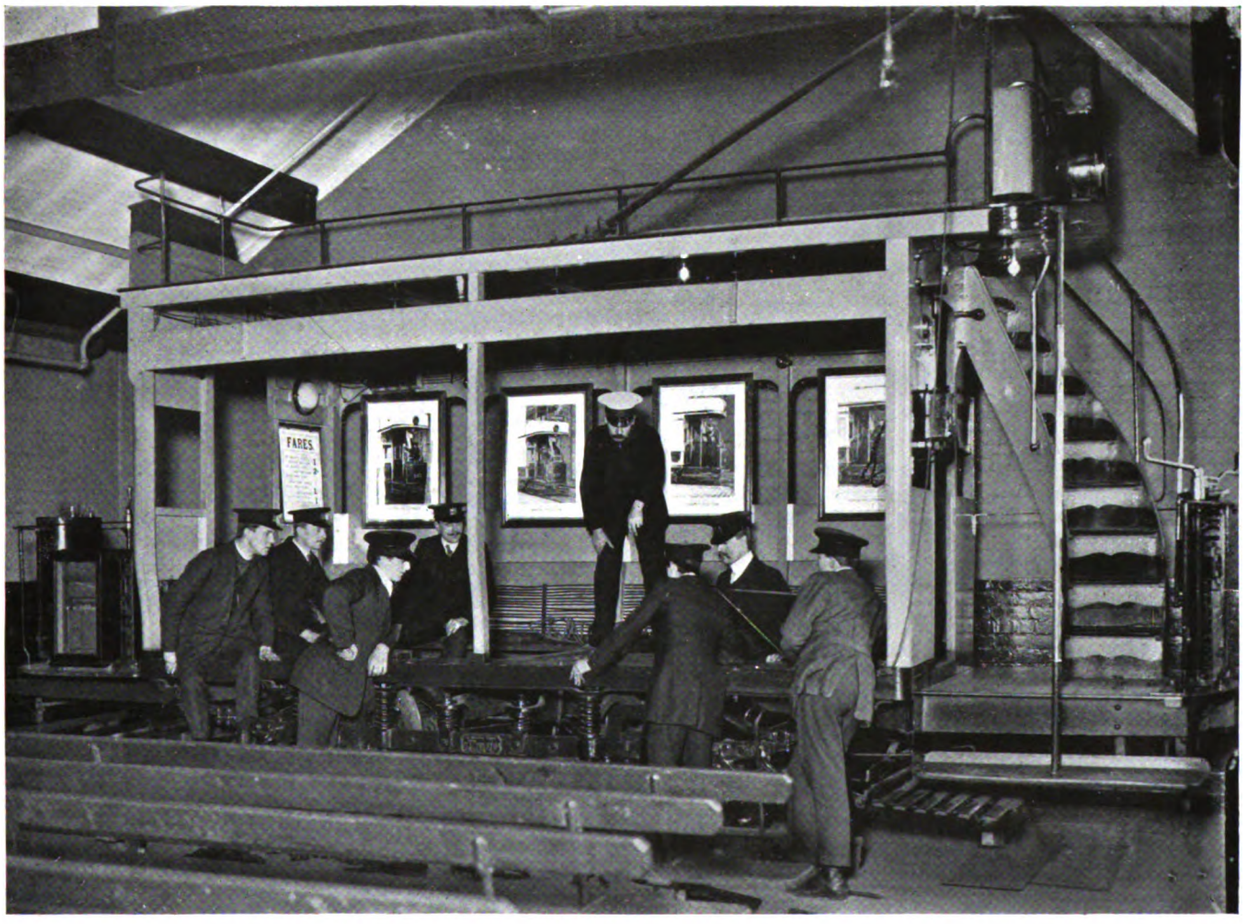
A Demonstration with the Skeleton Instruction Car.



A Group of Interested Student-Drivers.

Manchester Corporation's School for Drivers and Conductors.

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improper feeding up and rough treatment of the equipment, how to prevent accidents, how to deal with breakdowns and obstructions on the track, how to act in the case of the overhead wires falling, how to jack up a car and get a derailed car on to the track again. He is also warned against furious driving, etc.

He is then taken out on the school car. This is a special car for the training of drivers, and runs over portions of the system where there are gradients. On this school car he has actual practice in driving, and gets a knowledge of the traffic in the streets. He learns how to start and stop a car smoothly, how and when to use the electric brake, how to act in case of emergency, what to do in case the controller becomes locked with the power handle on running notches, what to do if the car starts to run backwards, how to find and cut out a defective motor, and how to locate faults generally.

When the instructor considers the man is competent he is required to sign an efficiency certificate (Form E). The rolling stock engineer then examines the learner on the use of the car equipment. Afterwards he goes before the traffic superintendent, who further questions him regarding the duties of a driver. He then appears

Manchester Corporation Tramways.

MEDICAL EXAMINATION OF EMPLOYEES.

The candidate must make the statement required below.

1. State your Name in full... ... ...
2. Age last birthday ... ...
3. What is your height, without shoes ? ... .
4. Nature of proposed occupation ... ...
5. What was your last occupation ? ... .
6. Have you ever been employed at any lead, mercury, or phosphorus process ? ... .
7. Have you ever spat blood or had rheumatic fever, habitual cough, asthma, disease of the heart, or any serious disease or accident involving absence from work for more than a week at a time ; or have you been invalided from, or declined after examination for, any public service or life insurance company ? ... ...
8. Have you or any of your near relations been afflicted with cancer, consumption, epilepsy, or insanity ? ... ...
9. Are you now in good health ? ... ...

I declare all the above answers to be, to the best of my belief, true and correct.

Candidate's signature .....

Date..... 19....

MEDICAL EXAMINER'S REPORT.

The Medical Examiner is requested to answer the following questions, after a careful examination of the candidate, and to transmit the form to the General Manager, Tramways Department, 55, Piccadilly, Manchester.

1. Has the candidate rupture, piles, or other swelling or varicose veins ? ... ...
2. Is the candidate's sight good ? ... ...

R. Eye.	L. Eye

3. Is the candidate's hearing good ?... ... .
4. Is the respiration natural, and are the respiratory sounds and the resonance of the chest normal ? ... ...
5. Are the pulsations of the heart natural in rhythm and force, and are its sounds those of health ? ... ...
6. Is the condition of the urine normal ? ... .
7. Is the candidate free from all physical defect and disease ? ... ...
8. Are there any circumstances connected with the health of the candidate which, in your opinion, tend to disqualify him from performing his duties efficiently ? .....
9. *Do you consider him well suited for employment in the service of the Tramways Department ?* ... ...

Signature of Medical Examiner.....

Date..... 19....

NOTE.—The Candidate will be held responsible for the accuracy of the above statement. By wilfully suppressing any information he will incur the risk of losing the appointment.

(FORM D.)

Manchester Corporation Tramways.

EFFICIENCY CERTIFICATE (DRIVER).

Questions.	Answers.
Do you know the various parts of the car and car equipment, including the truck, wheels and axles, life-guard, hand brake, electric brake, pedal gong, sand pedal, sand boxes, motors, gears and gear cases, main cables, resistances, controllers, choking coil, lightning arrester, automatic switch, the trolley and its connections, the lighting and bell arrangements, platform, steps, staircases, commode handles, panels, pillars, window guards, glass, &c.	.....
Have you been shown and do you understand—	
(1) How to use the hand brake, and especially how to do so without skidding the wheels ?	
(2) How to operate the electric and magnetic brakes—	
(*a*) When the car is running forward ?	
(*b*) When the car is running backward ? ...	.....
(3) How to use sand for starting and stopping ?	.....
(4) How to obtain sand for an emergency stop by means of the automatic sander, and which cars are so fitted ?	.....
(5) How to start the car without a jerk ? ...	.....
(6) How to stop the car without causing it to pitch ?	.....

Questions.	Answers.
(7) Why it is necessary to make a pause between each notch to allow the car to gain speed ?	.....
(8) How to get the car ready for service in the morning ?	.....
(9) How to leave the car in the shed at night ?	.....
(10) How to pass under circuit breakers, frogs, and crossings, and at what speed ?... ...	.....
(11) How to put in the automatic switch ? ...	.....
(12) How to put in the main lighting fuse ? ...	.....
(13) How to detect a burnt-out lamp, and what to do ?	.....
(14) How to cut out a motor, and the reason for so doing ?	.....
(15) How to keep the required distance apart when running, and what this distance is under various conditions ?	.....
(16) How to detect when the trolley leaves the wire, and what to do immediately ?	.....
(17) How to act in cases of accidents caused by the falling of overhead wires ?	.....

Signed (Driver).....

Signed (Motor Instructor) .....

Countersigned .....

Rolling Stock Superintendent.

(FORM E.)

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Manchester Corporation Tramways.

GUARD'S CERTIFICATE.

Full name .....

Address .....

.....

To the Traffic Superintendent.

Full inquiries have been made as to the character of this man from his employers during the past five years. The replies appear to be quite satisfactory, and are submitted herewith for your consideration.

..... *Correspondence Clerk.*

..... 19....

To the Traffic Superintendent.

This man has now passed the medical examination, and the doctor's certificate is sent herewith.

..... *Motor Instructor.*

..... 19....

To the Motor Instructor.

Please give this man the necessary instructions and practice to enable him to act as guard, and send him to head office when he has satisfactorily passed through the school and been properly trained on the various routes.

..... Road Depot.

..... *Traffic Superintendent.*

..... 19....

To the Traffic Superintendent.

This man has satisfactorily passed through the course of training in the School and on the various routes, and is now competent to guard a car.

..... *Motor Instructor.*

..... 19....

To the Traffic Superintendent.

During my training I acknowledge to have been thoroughly instructed on all the points mentioned in the book of instructions handed to me when sent to learn. I have carefully read this book.

..... *New Guard.*

..... 19....

To the General Manager.

I have personally interviewed this new guard, and questioned him in regard to the stages, fares, and issuing of tickets, and consider him qualified to guard a car.

..... *Chief Ticket Inspector.*

..... 19....

To the General Manager.

I have personally interviewed this new guard, and questioned him regarding the duties of a guard.

I consider he is competent to take charge of a car.

..... *Traffic Superintendent.*

..... 19....

This man appeared before me this day, and received final words of advice and warning prior to his licence being applied for.

..... *General Manager.*

..... 19....

(FORM I.)

Manchester Corporation Tramways.

DRIVER'S CERTIFICATE.

Full name .....

Address .....

.....

To the Traffic Superintendent.

Full inquiries have been made as to the character of this man from his employers during the past five years. The replies appear to be quite satisfactory, and are submitted herewith for your consideration.

..... *Correspondence Clerk.*

..... 19....

To the Traffic Superintendent.

This man has now passed the medical examination, and the doctor's certificate is sent herewith.

..... *Motor Instructor.*

..... 19....

To the Motor Instructor.

Please give this man the necessary instructions and practice to enable him to act as driver, and send him to head office when he has satisfactorily passed through the school and been properly trained on the various routes.

..... Road Depot.

..... *Traffic Superintendent.*

..... 19....

To the Traffic Superintendent.

This man has satisfactorily passed through the course of training in the school and on the various roads, and is now competent to take charge of a car.

..... *Motor Instructor.*

..... 19....

To the Traffic Superintendent.

During my training I acknowledge to have been thoroughly instructed on all the points mentioned in the book of instructions handed to me when sent to learn. I have carefully read this book.

..... *New Driver.*

..... 19....

To the General Manager.

I have personally interviewed and tested this new driver as to the use of the car equipments, particularly the brakes, and consider him qualified to drive a car.

..... *Rolling Stock Superintendent.*

..... 19....

To the General Manager.

I have personally interviewed this new driver, and questioned him regarding the duties of the driver of a car.

I consider he is competent to take charge of a car.

..... *Traffic Superintendent.*

..... 19....

This man appeared before me this day, and received final words of advice and warning prior to his licence being applied for.

..... *General Manager.*

..... 19....

(FORM H.)

[illegible] **Manchester Corporation Tramways.**

Name of Learner ..... *Badge No.* ..... Queen's Road Depôt.

Date		Route or Relief No.	The above-named Learner has worked the full Track value under my supervision: Signature	Badge No.	From	To
	Heaton Park					
	Cheetham Hill and Alexandra Park (via Albert Square)					
	Hightown and Chorlton					
	Newton Heath and Chorlton					
	Conran Street and Denton					
	Middleton					
	Moston and Stevenson Square					
	Hollinwood					
	Bradford Road					
	Cheetham Hill and Alexandra Park (via Deansgate)					
	Cheetham Hill Road and Brooks's Bar					
	Belle Vue					
	Middleton Junction					
	Oldham					

I acknowledge to have been instructed on all the above-mentioned routes.

Signature of Learner .....

Date .....

I am satisfied that this Learner has now completed his course of instruction on the above-mentioned routes.

Motor Instructor .....

Date .....

(FORM F.)

[illegible] **Manchester Corporation Tramways.**

Name of Learner ..... *Badge No.* ..... Princess Road Depôt.

Date		Route or Relief No.	The above-named Learner has worked the time shown below under my supervision: Signature	Badge No.	From	To
	Princess Road and Piccadilly					
	Victoria Park and Princess Road					
	West Point and Greenheys					
	Cheetham Hill and Alexandra Park (via Albert Square)					
	Cheetham Hill and Alexandra Park (via Deansgate)					
	Hightown and Chorlton					
	Newton Heath and Chorlton					
	Edge Lane and Old Trafford					
	Palatine Road					
	Southern Cemetery					
	Sale					
	Altrincham					
	Guide Bridge and Trafford Park					
	Cheetham Hill Road and Brooks's Bar					
	Belle Vue					
	Heaton Park					

I acknowledge to have been instructed as to the fares, stages, &c., on all the above-mentioned routes.

Signature of Learner .....

Date .....

I am satisfied that this Learner has now completed the course of instruction on the above-mentioned routes, and is now qualified to act as a Guard on these routes.

Motor Instructor .....

Date .....

(FORM G.)

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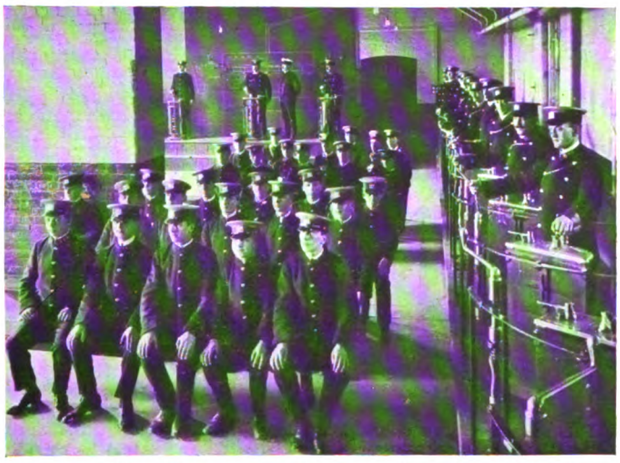
before the general manager, and receives final words of advice and warning prior to his licence being applied for (Form H). He is then put to drive a car on the training route for a month. He already has some knowledge of the traffic on this route through having worked on it as a guard. After completing the month he drives a car for a week on each route which turns out of the depot to which he is attached. The first day of the week he is in charge of an experienced driver, and is given a training card (Form F), and on the completion of the day's duty this driver must sign the training card and state the time the student has been under his supervision. This is done, as far as possible, in the presence of a timekeeper, who is required to stamp or initial the card. During the remainder of the week he drives on this route on his own responsibility. This completes his training, and he is put on the spare list. The period of training (including the time he is acting as a guard on the training route) usually occupies a period of about twelve weeks.

On entering the school a guard is shown how to punch tickets, is instructed in the fares and point places on the various routes, how to mark and extend the journey waybills, how to check his packets of



Motormen Receiving Instruction—Practice with Controllers—Manchester Motormen's School.

tickets with the lineway bill before commencing duty, how to pay in his receipts, how to act when accidents occur to passengers, and the best method of preventing accidents, etc. This usually occupies a few days.

He then commences to learn the various routes turning out of the depot to which he is to be attached. He is put with an experienced guard for one day, and given a training card (Form G) similar to that supplied to drivers. The guard must sign the training card, and state the time the learner has been under his supervision. A timekeeper must also stamp or initial the card. The following day the learner goes on another route, and so on until he has acquired a knowledge of all the routes. During this period he obtains the same general knowledge of the arrangements inside the shed as the student driver. He is then shown how to act if the car runs backwards, how to use a jack, how to get a derailed car on to the track again, etc. When the instructor considers the man is competent he is interviewed by the chief ticket inspector, who questions him in regard to the stages, fares, etc. He is then interviewed by the traffic superintendent, who further questions him regarding the duties of a guard. He then appears before the general manager, who gives him words of advice and warning prior to his licence being applied for, and he is put on the spare list.

The names of the experienced drivers and guards to instruct the students are selected by the instructor from a list supplied to him by the traffic superintendent.

NEW ZEALAND MIDLAND RAILWAY ELECTRIFICATION.

The English Electric Company, Limited, recently obtained from the New Zealand Government the complete contract for the electrification of the Arthur's Pass section of the Midland Railway of New Zealand, and the following particulars of the undertaking have been given in the *English Electric Journal*, which says that the contract was obtained in the face of keen foreign competition.

The railway at present runs from Greymouth, on the West Coast, to Otira, and from Lyttleton, on the East Coast, to Arthur's Pass, the two inland stations being on opposite slopes of the range of mountains which divides the South Island. To connect the two lines the New Zealand Government have constructed a tunnel between Otira and Arthur's Pass, and as the ruling gradient between the two stations is 1 in 33, electrification of this section was the only practicable course. The length of the section is $8\frac{1}{4}$ miles, of which rather more than 5 miles are in tunnel. The highest point on the line is 2,400 ft. above sea level, and 1,200 ft. above Otira. The climatic conditions are unusually severe; at Otira the annual rainfall approaches 200 inches, while snow is common in the district in winter and gales of great violence from all directions are experienced.

The contract includes the provision of the power plant, the transmission line, and the complete equipment for the electrical operation of the section, including main line locomotives for passenger and goods trains. The contractor is also required to furnish the tunnel lighting installation, to equip repair shops at Otira, and to train the staff needed for the operation of the line. The system adopted is 1,500 volt direct current with overhead contact. The power house will be situated at Otira Station, and the power will be generated by geared turbine direct-current sets. It is proposed that the boilers should consume dust fuel, in order to utilise the product of a number of local mines at which coal too fine for ordinary purposes is raised.

The railways of New Zealand are at present all steam operated, and it is not the intention of the Government to electrify for the time being more than the Arthur's Pass section. It is the more gratifying that the first electrification contract in the Dominion, and, indeed, the first since the war in the British Empire, should have been given to a British firm.

Maintenance of Roads by Tramway Companies.—The Council of the Tramways and Light Railways Association has brought before the Minister of Transport the question of the hardship imposed on tramway companies by Section 28 of the Tramways Act, 1870, dealing with the maintenance of roads by tramway companies. In a letter to the Minister the secretary of the Association, Mr. A. de Turckheim, stated that the cost of maintaining the roadway is excessive, owing to the great and increasing developments in road traffic, together with the enhanced cost of labour and materials, and it is a burden imposed upon tramway companies which was not contemplated by the legislature when framing the Act of 1870, and is unjust in its incidence to-day. The Council regard the matter as one of great urgency and express their confidence that the Minister will give his attention to it with a view to affording the companies the necessary relief.

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CRITICAL POSITION OF THE GERMAN TRAMWAY INDUSTRY.

In view of the critical financial position of the great majority of German tramway undertakings, and the threat of further prohibitive legislation, the Tramways and Light Railways Employers' Federation has addressed a manifesto to all magistrates and governing bodies of German cities. The industry, it is explained, is on the point of collapse, and the statement is issued at this time so that there may be no misapprehension as to the inevitable effect of further statutory reduction of working time. Unlike many enterprises, the tramway undertakings are dependent before everything else on the labour position, and the larger portion of their working expenses goes in wages. It is therefore apparent that they will be the first to feel any drastic interference by outside authority. A number of towns have recently decreed such formidable increases in wages, coupled with diminution in the hours of labour and a multiplication of holidays, etc., as to upset entirely the financial basis of the industry. One of the most prominent examples is Berlin. Only quite recently the city fixed wages at a level considerably higher than that established by the Industrial Court, and now, in spite of the fact that there has been no rise in the cost of living in the meantime, fresh demands on the part of the employees of the municipal tramways have been granted setting up a wages standard that is altogether out of proportion to anything existing previously. As a result of these successive concessions, the present remuneration per hour is approximately eleven times the pre-war figure. Reckoning the monetary value of the special concessions, such as increased pay on Sundays, four weeks' leave in three years, full pay during illness, etc., the total expenditure per hour worked is between fourteen and fifteen times the old rate. It is clear that this decision will be the signal for corresponding demands before the wages courts all over the Empire, and in view of the precedent the demands will probably meet with acceptance.

Such a burden is more than the tramways can bear. They are not in a position to raise their fares indefinitely in the way that many industries can raise the selling prices of their products. Nor can they look to foreign countries to find high prices for their wares. The use of the tramway is only in a limited number of cases an indispensable necessity, more often it is in the nature of a luxury. Accordingly the impecunious middle classes will no longer be able to afford to ride even for considerable journeys, and this sets a limit to the useful raising of fares. Once the limit has been passed the reduced number of passengers more than counterbalances the gain from the higher prices paid by those who still travel; receipts fall. Such a situation can only be met by reduced services in the first instance, and ultimately by liquidation.

Services have already been suspended entirely in Jena, Lahr, Wurzburg, Naumburg, Zittau, Meissen, Heilbronn, Zerbst, Freiberg (Saxony), Landsberg, Wittenberg, Eberswalde, and Altenburg (Saxony). In addition the stoppage of services is under consideration in Liegnitz, Darmstadt, Solingen, Osnabruck, Bielefeld, Bernburg, Guben, and Gera. In Berlin, Hamburg, Leipzig, Halle, and other large towns services are being cut down, and in some cases final closing is being postponed by selling to foreign countries motor cars that were on order.

In conclusion the report states that the extension to other towns of the conditions now imposed on the Berlin Municipal Tramways will inevitably seal the doom of tramways and light railways throughout the country. Local authorities are warned to bear in mind the disastrous consequences of their industrial policy. Not only will a very large body of workers be thrown out of employment by the closing of these transport undertakings, but many other industries will be seriously interfered with. Moreover, such a contingency would have a most serious effect upon the finances of the towns themselves. For instance, if the receipts of the Greater Berlin Tramways fell behind the expenses by only one penny per passenger, this would entail a yearly loss of 70 million marks. The idea of making good the losses from municipal funds that has been mooted is clearly impracticable, since the Imperial Government has appropriated all possible means of raising money in its own taxation schemes. Even the employees must see on consideration that it is not to their advantage to carry matters to extremes, as the critical position of the undertakings can only lead to wholesale dismissals. The Federation has instructed all its members to consider new demands from this point of view, and to refuse any further concessions. But this will not alone suffice to put the industry on an economic basis; if its position is to be re-established, a speedy fall in wages is an absolute necessity.

FINANCIAL REPORTS AND MEETINGS.

LIVERPOOL CORPORATION TRAMWAYS.—The estimated expenditure on reserves, renewals, and depreciation for the year ending December 31, 1920, is as follows—Renewals and alterations of tramway lines, £223,000; alteration to buildings, £9,000; alteration to cars, £4,000; car motor equipment, £40,000; overhead equipment, £2,000; contingencies, £6,000.

LONDON TRAMWAY RENEWALS OUT OF BORROWED MONEY.—The Treasury, while refusing to admit as a general principle that any part of the cost of renewals should be charged against capital, recognise that the position of the London County Council tramway undertaking this year is exceptional, and in the circumstances they have agreed that for the years 1919-20 and 1920-21 half the cost of renewals shall be charged against capital and treated as repayable in 12 years.

COVENTRY TRAMWAYS.—The Coventry Corporation Tramways obtained a total revenue of £89,393 in the year ended March last. The working expenses amounted to £78,459, and after adding capital charges the result is a net deficit of £7,066, as compared with a credit balance of £4,159 in the previous year. The percentage of working expenses to receipts was 88, while a year ago the percentage was 74. Passengers decreased by 650,000, making a total of 15,904,905.

OLDHAM, ASHTON AND HYDE TRAMWAYS.—The directors of the Oldham, Ashton, and Hyde Electric Tramway, Limited, announce that the arbitration respecting the decision of the local authorities to purchase the undertaking has resulted in the arranging of the purchase for the sum of £142,174. The issued capital of the undertaking is £100,000 in £1 shares, divided into 50,000 ordinary and 50,000 preference shares. The directors state that there will be a surplus available for both classes of shareholders after the repayment of capital.

NORWICH ELECTRIC TRAMWAYS COMPANY.—The report for the year ended June 30, 1920, shows that the total receipts amounted to £72,464, and expenditure to £61,601, leaving a net profit of £10,863, or a decrease of £3,014 as compared with the previous year. In view of the increase of £14,617 in receipts, the result is disappointing. Including the sum of £167 brought forward, there is a total of £11,030. The directors recommend that £740 should be appropriated to writing down the cost of a turbo-generator, and the balance of £10,316 be placed to the reserve account. As provided under the Norwich Electric Tramways Act, 1914, the Corporation of Norwich will appoint a director to represent the city on the board during the ensuing year. The following particulars are taken from the report—Number of car-miles run, 947,448 (192,101 increase); number of passengers carried, 14,671,084 (2,194,365 increase); earnings per car-mile, 18·36d. (·02d. decrease); expenses per car-mile, 14·94d. (1·88d. increase); earnings per passenger, 1·16d. (·05d. increase).

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, NOVEMBER 18, 1920.

The Motor Omnibus in America.

The advent of the motor omnibus into the field of electric traction in the United States was officially signalised by the reading of three papers on the subject before the annual convention of the American Electric Railway Association at Atlantic City in October. Hitherto the American street railway man as a rule has looked with suspicion and dislike on the omnibus, as he saw in it the possibilities of a formidable competitor to his tramway. Omnibuses were run by rival concerns, and at first were evidently subject to no control or taxation. Hence the competition might rightly be described as unfair. The control and taxation appear to be imminent now. That the omnibus may be used as an auxiliary to the street railway is slowly being appreciated, but so far only a limited number of the companies have actually begun to run omnibuses. In this they have lagged behind the tramway authorities in this country, but now they are waking up. One of the three papers referred to was by an officer of an electric railway company, and the conclusion he arrived at was that the place of the omnibus is as an extension of street car lines into territory of light traffic possibilities, and also over routes where extra fares can be charged. A second paper was by a representative of a motor car company, and he advocated the operation of auxiliary omnibus services by electric railways. But the most important of the three papers, and one which may prove quite epoch-making in American transportation annals, was one by Mr. George J. Shave and Mr. Frank Pick, respectively manager of maintenance and commercial manager of the London General Omnibus Company. This paper, with its wealth of practical experience and grasp of the details of motor omnibus operations, must have come as an eye-opener to many members of the American Association.

The Sphere of the Omnibus.

It is a very unusual, if not an unprecedented thing, for any British traction officer to present a paper to the American Association. But the members of the Association are wide awake, and they probably recognised that if they wanted to learn about the operation of omnibuses London was the place to which to apply. London was the pioneer in motor omnibus services, and the undertaking of the London General Omnibus Company is by far the biggest thing of the kind in the world. Then Mr. Pick and Mr. Shave, a little over a year ago, were able to make themselves personally familiar with American urban transportation methods and with many of the men responsible for the work, because they were members of the deputation from the London underground railway combination who visited the United States on a mission of inquiry. In their paper, which was read in their absence, they examine from every angle the question of the advantages and disadvantages of the omnibus as compared with the tramway, with the object of arriving at conclusions as to which is the preferable instrument under different conditions of traffic density. The paper (an abstract of which appears in this issue) does not give details of working expenses, but these must have been assumed on some basis. So also must have been capital cost for an omnibus undertaking and for a tramway undertaking. Whether the capital cost per mile of the London County Council tramways, or the much less costly type of tramway in other English towns, is taken as the basis is not apparent. However that may

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be, the authors draw up a scale of passenger densities, and excluding from their purview consideration of the railless system, put forward the conclusion that for light traffic the omnibus is the more economical, that for medium traffic the two systems are about equal, that for heavy traffic the tramway is preferable, and that for very heavy traffic recourse must be had to underground or elevated railways. The cost of working in all cases evidently includes capital charges. There will be a measure of agreement in a general way with these conclusions ; where difference of opinion comes in is with regard to the scale—that is to say, at what points exactly the one method becomes superior to the other. Much of the paper is educational in the sense of demonstrating the convenience, flexibility, and transferability of omnibus services, and much London experience is epitomised in it. The American street railway men were evidently more anxious to get information than to talk on a subject with which they were not very fully acquainted, because there was no discussion on any of the three papers.

A Direct Challenge to Industry.

At the special meeting of the National Joint Industrial Council for the tramway industry, Mr. Ernest Bevin, speaking for the employees, made a statement which is of some significance in considering the future of tramways in relation to labour. He expressed willingness to appoint, jointly with representatives of the municipalities, a committee to investigate "all the facts" relevant to the wages application. He then added—

> We are not prepared to make wages dependent on the financial condition of the respective undertakings, but adhere to the principle that we are entitled to advances comparable with the admitted increases in the cost of living.

Interpreted as an indication of Labour policy by so redoubtable an exponent as the "Dockers' K.C.," this assertion raises a vital issue. The most serious problem facing those responsible for the management of tramways is that of keeping expenses within estimated receipts. Many undertakings fail to make the two balance, and a subsidy from the rates is the result. Fares have been increased almost to the point of being unremunerative ; in some cases, indeed, it is thought that the unremunerative point has actually been reached. At any rate it is notorious that growing operating and labour charges cannot be met *ad infinitum* by increasing fares. In the case of the municipal tramways the labour apostles doubtless have in mind that any deficit can be made good from the rates. The private companies—whose withdrawal from the Industrial Council is, we hope, only temporary—cannot continue if the principle of making them pay has to be ignored. Probably the advocates of wholesale municipalisation and nationalisation view that prospect with equanimity. But Mr. Bevin's statement has a wider application. Labour is claiming the right to govern this country, and its policy in the set formula of the Socialist text-books is the nationalisation of all means of production, distribution, and exchange. Is the same indifference to commercial success to be part of the wider policy ? Will Mr. Bevin and other would-be members of the first British Labour Cabinet say that wages paid to the workers must have no relation to "the financial condition of the respective undertakings" taken under State control when our nationalising advocates sit in the seats of office ? These are vital issues, for the Labour answer, so far as we see it, foreshadows State subsidies right and left, and while the burden on the taxpayer is to-day heavy enough in all conscience, the burden then will be simply intolerable. To declare that wages must bear no relation to financial success is a grave challenge to an industrial nation.

The Future of Transport.

The task of reconstructing industry is still far from completion. Especially is this the case with transport of every description on land ; but slow as the measure of progress is, the work will be best accomplished by those who are actively engaged in the various forms of transport. This assertion is particularly true of the provision of educational facilities. Apart from a few University general courses of study, the classes for various grades provided by the chief railway companies, and the efficiency meetings of the London Underground Group, the aspirant to higher things has been thrown upon the limited resources of self-help. Exceptions exist to this rule, as far as road transit is concerned, for young men who are so fortunate as to become

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pupils of managers. Transport generally will benefit if a desire to study can be kindled among a larger number of its workers. Indeed, education in the technicalities will be imperative if good results are to follow from any such development as giving wage earners a share in control. The railway unions aspire to such a responsibility, and, with Sir George Gibb's further advocacy of co-partnership, the future holds some interesting possibilities. In the work of disseminating enlightenment and of guiding studious men into the right paths, the Institute of Transport is destined to play a leading part, if papers read to the members attain to the high level of the presidential address of Lord Ashfield. As might be expected from a man with engineering and managerial experience in two hemispheres, his address on "Education and Training in Transport" does more than hold the interest of the reader. It will convert the unconverted if any such men exist. It traverses the ground more completely than has been done before, and is remarkable for its wealth of practical suggestions. The application of one suggestion to the work of the Institute will decide the extent to which the organisation is to become useful to the industry. It is contained in the president's wish to see his year of office devoted to laying down a policy and developing a plan which would deal with the Institute's educational activities and aims. For this purpose he suggested the appointment of a committee charged with the task of reviewing in detail all the steps which have already been taken and of considering what further steps can be agreed upon. While admitting that just now transport is not a very profitable business, Lord Ashfield rightly insists that transport must afford to educate its youth, and he indicates measures that can be taken towards that object. Practical men will not need to be reminded of the advantages that have accrued to other industries which have adopted that course.

Southampton Corporation Tramways.—During the past year the traffic receipts constituted a record—£147,093, as against £130,567—an increase of £16,526 over those of the previous year. The passengers numbered 26,085,649 (a decrease of 937,892), miles run, 2,032,620 (increase, 253,839). The total receipts averaged 17·37d. per car-mile, and the working expenses 14·69d. per car-mile. The tramway year ended on March 31, and since the period covered by the report the general manager (Mr. J. Dobson) has developed omnibus services, which are to be further extended in consequence of the enlargement of the borough boundaries.

IMPROVEMENTS IN GEAR CASES.

By an Occasional Contributor.

Few items of tramway equipment appear to give so much trouble to the engineer as the gear case. Go into any tramway depot and you will always find a number of derelict gear cases about—some with whole sides broken away, some with lugs torn out, while others are chipped and cracked and only fit for the scrap heap. Normally one would think that this part of the tramcar would have a long life, having merely to enclose the running gears and not being subject to any direct wear. Why then should there be such heavy casualties in gear cases resulting in continuous renewal expenses? Apparently the only answer is that this part of the original design received too scant consideration in the early days simply because it had nothing more to do than to enclose the gearing.

One of the worst faults was that it was bolted by its side to the motor case and extension, an impracticable method of holding a heavy malleable iron casting, and one which certainly invited trouble at this point. That this was a mistake is now a freely acknowledged fact, and is proved by the most recent designs of gear cases showing the end suspension arrangement. Nevertheless a number of systems still maintain the old form of side suspension, and the many consequent troubles are being patiently or otherwise borne.

During the war malleable iron cases were almost unobtainable, and many were the ideas which arose to cope with the situation. Some installed either oxy-acetylene or electric arc welding plant, and proceeded to the best of their ability to tinker up the derelicts. Others turned to the pressed steel type of gear case as a procurable substitute. What was the result? They found that many of the supposed objections did not exist, and that others were more than compensated for by the numerous advantages to be gained; and many are to-day exclusively using the sheet steel gear case who were formerly its most emphatic opponents.

The pressed steel gear case has many virtues not possessed by the malleable iron construction which we have known for so long. One of the chief benefits is that of light weight. The pressed steel case which reduces the dead weight to be carried is a mere fraction of the weight of its predecessors, and this tells in the work of fitting in the depot where renewals can be very quickly effected by the light weight to be handled. Further, the pressed steel case has a certain amount of elasticity, which allows it to be better set to the local conditions of the fixings; this is no small matter in practice, as variations will occur in alignment which are not met by the rigid type of case.

The charge that the pressed steel case is noisy or works loose in practice is entirely wrong. Where such occurrences have taken place they have been probably due to bad fitting and improper locking of fixing bolts. If the fixing bolts are tight the running should be quite silent under all conditions.

In the Espot welded and rivetted gear case, as supplied by the Equipment and Engineering Company, the construction is effected by a combination of rivetting and spot welding. This is the whole secret of their success. To use rivetting or spot welding alone would result in failure. Each has its respective merits and limitations, and it is a curious fact that one balances the other. When we consider the enormous amount of vibration upon a tramcar,

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it is easy to understand the amount of strain to be resisted. The plates forming the case make every endeavour to move in respect to each other, and with simple rivetting this would soon result in a cutting action or shearing at the rivet holes, and the rigidity of the fixing is impaired and it soon works loose. Once this occurs the effect is cumulative, and other neighbouring rivets which had previously held firm become affected. In a short time the whole case is loose and rattling, and further damage ensues.

Consider now the effect of a gear case constructed with spot welded joints only. With all due acknowledgment to the high degree of perfection which spot welding has attained, it still has drawbacks which are difficult to surmount. One of these is the question of certainty in the nature of the adhesion of the joined surfaces, and the difficulty of proving the effectiveness of the joint once it is made without actually cutting it open. Should any oxidised scale be present upon the surfaces of the metal prior to the application of the process, it is practically impossible to assure that the weld will be effective and strong. This means that spot welding is largely a matter of perfection in workmanship and thorough supervision—a matter which is too frequently overlooked. Frequently it has been proved that joints which are to all outward appearances sound after being made come asunder when the work is put under strain.

A further point is the fact that the intense heat of the action of welding may soften the steel in the immediate locality of the weld. This reduces its tensile strength, and renders the joint unfit to withstand vibration or strain. This effect is more pronounced with certain grades of steel than others, and in the Espot gear cases very careful attention is paid to this detail in the selection of steel of a composition which will withstand the heat without any serious deterioration in the material.

By combining the two methods of securing the joints in the steel plates a perfect system of construction is assured, for any liability to shear the rivets is neutralised by the spot welds. Another greatf eature in the Espot cases is that of design. The sides are diepressed to shape with ample overlap joints. Reinforcing plates are then added to strengthen the portion where the strain is taken. These, together with the fixing lugs, are also spot welded and rivetted in place. The fixing lugs themselves are formed by solid forgings amply ribbed to resist strain. In this respect alone they are a considerable improvement on the simple cast extensions of a malleable iron case, which often suffer from imperfections in the annealing and fracture, leaving the case useless or involving a difficult repair.

INSTITUTE OF TRANSPORT.

First Annual Meeting.

The first annual meeting of the Institute of Transport was held at the Institution of Civil Engineers on October 18. Sir Joseph G. Broodbank, who took the chair, said that Sir Eric Geddes, the president, had written expressing his great regret that he was prevented from being present owing to duties connected with the coal strike. He was sure that if Sir Eric had been there he would have congratulated the Institute upon the great success which it had achieved in the short time since it was formed. They were indebted for that progress both to their new president and to Mr. Blain, and to many others who had assisted them. Sir Joseph then asked the president-elect, Lord Ashfield of Southwell, to take the chair, and give to them his presidential address.

Lord Ashfield, having referred to the retiring president, then delivered his presidential address, the full text of which is appended.

EDUCATION & TRAINING IN TRANSPORT.

PRESIDENTIAL ADDRESS BY LORD ASHFIELD TO THE INSTITUTE OF TRANSPORT.

What is transport? And someone will prosaically answer, the carriage of passengers and goods from place to place—a barren definition. Oftentimes it is referred to as an industry. The toil and effort that it demands are patently recognised. Sometimes it is described as a science, for the complexity and skill that it involves are seen by some. Rarely does anyone look at it from the outside as a whole—to see the wood and not the trees—to realise that it is one of the triumphs of man. When they do, they realise too that it is a whole phase of our civilisation. It is the foundation upon which our present civilisation rests. In its progress is our life.

The nomad wandered over the face of the earth seeking what he wanted—grass and water. He pursued the favourable seasons, even as the birds migrating to the south, because there was no transport. Soon he learnt that he could send and fetch what he wanted. He settles, and transport begins. It is a paradox. When he stayed in one place, only then was he able to take the first steps in civilisation. And when we think of the progress of transport, our mind seems automatically to revert to one aspect only, the means of transport. We pass in review a strange and varied sequence of draught animals, the wind that bloweth whither it listeth driving before it the venturous galley and great argosies, flowing water bearing strange vessels, from the curious craft of the rivers of Babylon that drift down upon the floods, inflated skins laden with goods, only to be packed up empty and taken to the headwaters once more on donkeys, to the vast lumber rafts that still come down the magnificent rivers of America. With what little change these had sufficed for numerous centuries.

Then suddenly there came the revolutions of the nineteenth century. The first locomotive and the first railway made their appearance. Mechanical traction had arrived with a triad of powers—steam, electricity, oil. What did it mean? I cannot do better than quote our latest world historian, Mr. H. G. Wells—

> "Here was a sudden change in what had long been a fixed condition of human life, the maximum rate of land transport. After the Russian disaster, Napoleon travelled from near Vilna to Paris in 312 hours. This was a journey of about 1,400 miles. He was travelling with every conceivable advantage, and he averaged under five miles an hour. An ordinary traveller could not have done this distance in twice the time. These were about the same maximum rates of travel as held good between Rome and Gaul in the first century A.D., or between Sardis and Susa in the fourth century B.C. Then suddenly came this tremendous change. The railways reduced this journey for any ordinary traveller to less than 48 hours. That is to say, they reduced the chief European distances to about a tenth of what they had been."

Progress in transport is causing the world to shrink so rapidly that the only excuse that remains to us for not seeing what it means is the very novelty of it.

I wish to spend a few moments in opening up three or four of the wider aspects of progress in transport, because they seem to me important for our understanding. We all allow that trade and commerce live by transport, but we may doubt that empery and all the imperial ideas live by it also.

We learn how the mighty empires of the Middle East were framed upon a network of great roads. The royal road from Sardis to Susa was 1,500 miles long, with post houses along its route and a postal system of fast-riding couriers for the royal business. So important was this road that it was shown on the earliest maps as a straight line east and west, and the rude geography of the countries it traversed hung about it. The prosperity of empires depended upon the maintenance and control of these roads. It was an era of road power. Empery was grounded in transport.

The Greeks depended upon sea power. The first colonists of Athens were those sent to police and guard the sea route to the Black Sea, along which the corn flowed in to the hungry cities. So this need for the safe transport of food lead to the establishment of the Athenian Empire. Rome, as we all know, covered half of Europe and parts of Asia and Africa with colonies, held together once again by a system of roads. And we might pass from empire to empire throughout history until we reach our own.

The records of history contain nothing more marvellous than the accidental accumulation of the British Empire, and nothing which marks more clearly the foundation in transport and in the trade and commerce which spring up around it. It is only necessary to recite the names of the principal colonising agencies to prove this: the Merchant Adventurers of 1554, the Virginia Company, the East India Company of 1600, the Hudson's Bay Company of 1670, down to the British South Africa Company, which as late as 1889 occupied

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some 750,000 square miles of Africa as a private speculation. "Trafficke" was the incentive of the old English navigators, and where they "trafficked" first grew up the trading factory, then the plantation or colony, then the town, and so in course of time an overseas dominion. They were private exploiters of the world whose accomplished tasks were taken over by the State. Stage by stage, transport has enlarged the conception of empire and alone made it possible.

Lately we have had brought home to us that war itself is subservient to transport. It has become almost ridiculous to reckon the size of olden wars. The decisive battle of Marathon, which rescued the civilisation of Europe from Eastern domination, was fought and won by an Athenian army of 9,000 men. At the Battle of Waterloo less than 75,000 men fought on each side. The Franco-German War of 1870, which was the last continental war, was waged altogether by 2,500,000 men. The first world war from start to finish was waged by 50,000,000 men. A few weeks ago the *Railway Gazette* gave summary figures for the transport between England and France in the five years of war

Men	10,800,108
Animals	808,363
Vehicles	442,994
(In itself a sign of transport.)	
Supplies and ammunition ...	26,384,073 tons

Stage by stage, it is transport that has made war on this scale possible.

Or take note of the population of the world. 1,656 millions of people scattered over 50½ millions of square miles, which gives an average density of 33 to the square mile, or curiously enough, the density of population in the United States. Yet transport has altered this average picture entirely. Belgium supports 672 people to the squate mile, Holland 514, and Great Britain 374, because of transport. It has permitted the industrialisation of whole nations relying upon the agriculture of primitive peoples for their daily food. It has permitted that specialisation of function which is at the bottom of the success of our material progress. Yet this is not all. Greater London supports a population of over 10,000 to the square mile, Greater New York of over 17,000. The population of Greater London alone is to-day between two and three times more than the total population of the country in the splendid times of Queen Elizabeth. Stage by stage, transport has made these vast aggregations possible.

It has meant civilisation. Transport has enabled the exchange of much more than goods. With the food from the four corners of the earth we have taken in ideas. With the raw products we have borrowed inventions. It has meant a community of progress throughout Europe, but of a Europe in which Russia holds no real part. Russia is left outside because of its defective transport. It has not kept pace with the rest. It is impossible in a partial isolation to achieve the advances which social intercourse enjoys, and this being left outside is not without its peril to those within. Intercommunication creates the national consciousness. Until we know that there are foreigners deserving of regard, we do not know that we are English deserving of regard.

There is an interesting parallel which illustrates this result of transport most effectively. In the fourth century, and for several centuries after, Europe was overrun by a succession of migrating hordes. Their advance westward was slow. Some settled here, some there, mixing with the original inhabitants in varying degrees. In some places later waves submerged earlier waves. There was then little communication except along the rivers and the surviving Roman roads, and what there was was dangerous. So these groups of settlers stayed and multiplied, and grew up in little communities to form the Europe that we know to-day, full of a monstrous, warring brood of nationalities, self-centred, divergent in purpose and character.

That is one picture; now look at another. From the seventeenth century onwards, by a process which gathered strength in the nineteenth century, and is still continuing, migratory hordes are once more moving westwards into the United States of America. In spite of all the nationalities, there is only one American people. Why? The railways link the whole of the States together. There are 275,000 miles of railway out there, tying the land together in bands of steel. The speed of movement is too quick to permit of the development of national idiosyncrasies within the States. The very diversity of the land is become by transport a bond of union, so that the miner of the west, the rancher of the central plains, the wheat farmer of the middle west, the cotton planter of the south, the industrialist of the north-east, have mutual aims and interests, are establishing common ideals. The United States of America is the first continental state based on railways, and it is not a national state. This has saved America all but one war, the Civil War of 1861. But for modern transport it might have repeated all the wars of Europe.

As of war, so transport is thus the foundation of peace. There cannot be too much. In the world war which has cast so heavy a shadow over the merits of our progress, there were redeeming lights. The interdependence of the world was first fully realised. A world consciousness crept into being, and we had conferred upon us a new instrument of transport, three and four times more speedy than the old, the aeroplane. The Atlantic has been crossed in a day. The world is lessened once again. If railways have enabled the United States of America to stretch across a continent from New York to San Francisco, a space of 3,270 miles, and to build up a single consciousness, surely the airways of the world may link together just as closely the "Five Nations" of the British people.

All this while, you may be troubled to know why I have had this curious information and timely reflection brought together, apart from its general interest. I want you to appreciate how wonderful is the task to which you have been called, how mighty are the effects and influences of the work upon which you are engaged. Here is a power which can make and unmake empires, can establish war or peace, can fill the earth with happy, civilised people, or blot out populations in famine and pestilence. How seldom we remember this. How seldom we stop and let our imagination loose, calculating the power that is entrusted to our hands. If we thought more, there is one thing which we should admit we needed more, and that is education and training for the proper discharge of the duties falling to us.

The rest of this address will be devoted to this subject of education and training. That is the central subject to which I ask you to address your attention. I only hope my long introduction has convinced you more certainly of its importance. And as I have asked you to take a more than usual breadth of view in regarding transport, so I ask you to take a more than usual breadth of view regarding education.

Because it involves specialised knowledge, transport is spoken of as a science and is taught as a separate subject. Yet transport is not a science so much as the practical application of many sciences to the solution of a special type of problem. There enters into transport engineering in all its branches, civil, mechanical, electrical; economics in its most liberal extension; statistics and the imaginative treatment of figures; psychology in its modern social implications. There come in as well those descriptive sciences, law to govern our actions; geography, natural, commercial and physical. All these establish principles of which transport affords illuminative illustrations in practice. What we have to seek, therefore, is not the setting up of a science of transport, as though it were a thing apart, but the drawing upon all science to enrich our comprehension and knowledge of transport as a fact. Our aim must not so much be to convey a mass of specialised information as to educate the faculties to find out and use well the specialised information that flows in upon us in our daily tasks. Our aim must be to ensure that every approved scientific method is fitly applied to transport.

And by scientific methods I am not thinking of the scientific management which has been exploited in America, and which is now spreading over here. I am not thinking of merely securing a greater practical efficiency in detail, of getting the greatest results out of the least effort, excellent as all that may be in its proper place. I am thinking of the way in which problems of management should be tackled, not by trial and error, not by guesswork, not by slow and tentative adjustments, but by the knowledge gained from ordered experience. A knowledge which must be gained by a wide survey that gives to everything a true perspective.

Fortunately, there are now several schools in which this knowledge can be learnt. Principal among them is the London School of Economics, founded in 1895, and matched by departments in some of the newer universities such as Manchester, Leeds, Newcastle. It is all very recent. Twenty-five years would cover its history. The first Faculty of Commerce to be organised in this country was at Birmingham in 1802. It was only last year that the London University instituted its Faculty of Commerce, a step for which much credit was taken in the city and in business circles. Even in America the earliest steps in business education date back to 1860, but these steps only grew into a definite curriculum by 1892 in the University of Pennsylvania. The unique school of Railway Engineering and Administration in the University of Illinois started about 1895. Now in both countries schools are multiplying. The wise policy must be to organise strong and vigorous schools in convenient centres, and to prevent unwholesome competition which might weaken them, as by the duplication of schools with the consequent dissipation of resources. It must be the aim and object of the Institute of Transport to support and encourage such schools, to extend to them recognition, and to assist them to the limit of its means. So it will fill in some measure the words of Article 3 of the Memorandum of Association—

"To promote and encourage knowledge of traffic science and of the art of transport in all its branches, and the means and

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appliances connected therewith; to provide facilities for the study of and exchange of information and ideas on traffic problems, and all means and methods of transport."

The principal railways of the country are beginning to be alive to the need of thorough training in this knowledge. Twenty years ago they hardly cared. To some, what had been good enough in the past was good enough now. Success had spoiled them to an over regard for their attainment. In all commercial and operating matters the rule of thumb was the standard of management, even as the Chancellor's foot was once the standard of equity in the Courts. The railways had the good fortune to enlist in their service great practical geniuses, and became prosperous and expansive. These men were the exception. The rank and file toiled along in a routine way, knowing little except the task before them, and performing that year in year out in a perfunctory way, without change or improvement, except of a minor character. Given right education, this could not continue, healthy unrest must burst into the offices. Such education cannot rob us of our geniuses, and it will lift the rank and file to a more intelligent use of their faculties, and so bring up the work to a higher general level of attainment.

This Institute of Transport, which reaches its first birthday, is the finest augury of the awakening which is coming. Railwaymen (and I single them out in no invidious sense, but because they are the most numerous body of our members) have become conscious of themselves as a class, as public servants; and they are anxious that that class shall be distinguished for its ability, for its knowledge and for its skill. That, I take it, is the real meaning of this Institute of ours. I see we have on our membership lists 45 graduates and 31 students. What are we doing to turn them out competent and reputable members who will be a credit to us? With few exceptions they are all practically and busily employed in transport, as you may see from the lists, but there is nothing to show that they are being educated in that scientific knowledge of which we have been speaking. I do not wish to belittle the series of monthly lectures that have been arranged on their behalf. I appreciate the value of them as showing the great interest of some of our distinguished members in the task of education in that they are personally labouring to fill the gap. I appreciate the value of them because they must be a keen incentive to further study and inquiry, but it is the steady, constant provision of opportunities for study and inquiry that must follow to give them their real value. The Institute needs, if for nothing else, to associate itself with the schools and ensure ample and sound provision for this education.

That is the best way to fulfil some more words which I take from Article 3 of our Memorandum of Association—

"To provide for the delivery of lectures, the holding of classes and examinations, the awarding of certificates, medals, scholarships and diplomas in connection with traffic and transport."

There must be scholarships and, if you will, medals and other prizes of success. Transport just now is not a very profitable affair, but because of its necessity we can have a firm hope that that will quickly right itself, and it must not deter us from being prepared. Transport must afford to educate its youth. The large companies and undertakings must be prepared to second their promising recruits, paying not only the fees but a generous subsistence allowance. Maybe, through this Institute, we may rid our previous individual efforts in this direction of their selfishness. We may aim at education and not at more efficient clerking, to the end that we may attain an accomplished member, an ornament of the Institute, as well as an accomplished officer, the joy of his company.

And all this while I know that, so far, I have only been skirting the fringe of this subject. This training and learning is only the commencement of a full and complete education. It gives knowledge. It gives method. It gives alertness. But, until experience is gained of the application of this knowledge, the scope of this method, the value of this alertness in transport, who shall say whether anything worth while has been gained?

An engineer spends five years on his training. A doctor spends six years in preparation for his career. Both have three years of general education in arts and science, and, after that, two or three years of special education in the practice of their calling under educational conditions. Nothing less must serve us.

I turn again to speak especially of railways because they are large, elaborately organised corporations. Their organisation is usually on a departmental basis, and often the departments are watertight. A man gets into a department, and there he sticks. He sees before him a narrow avenue of promotion. The more fitted he becomes to perform his own job the more difficult he may find it to get out of that job. Even within a department promotion is sometimes confined to the petty hierarchy of the staff in some section of it. We have to ask ourselves whether this is right. We might even ask ourselves whether, from a selfish point of view, this pays the company. Some of the failures in our offices are caused by the impossibility of putting straight a bad start. Only by shifting from post to post can the capacity of a man be brought to the test and turned to best account. I want to urge, not for a selected few, but for all employed in the railway service, a chance or several chances in the opening years of their employment as the best policy for the railways themselves.

We may also ask ourselves whether the departmental organisation is not carried too far. Three kinds of capacity are wanted on railways: capacity to make and do, capacity to buy and sell, capacity to plan and think. Very occasionally are these capacities combined at a high level in one individual, but, given one of these capacities, it has aptitudes for many varieties of work. Take the makers and doers. They are the engineers and superintendents of operation. Should they not have a common training and a common prospect? Should they not specialise at a much later stage of their career than is the case? Their initiation into business life stamps them finally as civil or mechanical engineers, superintendents of trains or docks. The same argument applies to the buyers and sellers. How early they get into ruts as goods or passenger or mineral agents! This intensive culture of ability may provide a succession of efficient officers for a department, but it will never revolutionise the department. It is a plan to foster conservatism and tradition. It will never supply, except by accident, a first-class general officer. Unless specialised training and experience is only a graft upon a broad training and a varied experience it unfits a man for general management, of which the chief endeavour must be to secure coherent action by many departments.

Professor Alfred Marshall, in his recent work on "Industry and Trade," attempts to define the qualities of the head of a large business. It is an interesting attempt. He says—

"The chief requisites of the head of a considerable business may be classed as (*a*) judgment, prudence, enterprise, and fortitude in undertaking and carrying risks; (*b*) an alert acquaintance with appropriate technique, and some power of initiating advance; (*c*) a high power of organisation, in which system plays a great part, but 'always as a servant, never as a master'; (*d*) a power of reading character in subordinates, together with resolution, tact, trust, and sympathy in handling them; (*e*) prompt diligence in assigning to each the highest work of which he is capable, or can be made capable within a moderate time."

Think of the catalogue—judgment, prudence, enterprise, fortitude, resolution, tact, trust, sympathy. These are all moral qualities, elements of great character. Can they be satisfactorily learnt in a departmental school? Surely the time has come when we must throw open the doors of experience so that with knowledge we also get understanding. Only then may we be sure of the great general officers coming to the front when they are needed to conduct the great affairs of transport worthily. As an American has said: "There are many who can manage a million dollars, few who can manage ten million, and next to none who can manage fifty million." Or, as I have said myself in an incautious moment: "There are many who can earn £1,000, few who can earn £5,000, and next to none who can earn £10,000 or £15,000."

I am tempted to advert to yet another drawback to the departmental system of promotion, and to the narrowness of common experience, because it relates to a subject which grows yearly in importance. Nowadays, the opposition of labour and management looms large, and threatens at times the co-operation that should hold its place. No one can doubt that labour is making rapid advances. It tries to learn, and it is beginning to understand, though uncertainly. This is all to the good. But, unless management will also make rapid advances, it will be hard put to it to maintain its position. It, too, must try to learn. It must understand more thoroughly. Labour problems are not the peculiar problems of a particular industry. They are much broader. They have their roots in political and social aims. Their solution demands an experience of affairs beyond the confines of a single business. Every settlement with labour is only a specialised accommodation comprised in some vaster movement. It is but a crowning instance of the point I have been trying to make, that only by the widest and most varied training can we hope to bring to light the ability, the statesmanship that is at the heart of good management. It is easy to know things, difficult to know men. Given a sound character, it is only by a liberal and extended experience of affairs that an officer can handle successfully those labour problems which bulk so large, and occupy so much of our time.

I do not want to labour the point, but it is essential to good organisation and sound management, as I see it, to widen the practical experience of those who are to succeed us and, we trust, excel us. It is essential to add to an earnest training in the school a varied practice and a broad outlook in business; and in the concluding portion of this address I want to speak of the steps that have already been taken to this end, and the further steps that must be taken, and to close with a practical suggestion.

The first stage is the interdepartmental exchange of staff within an undertaking. I have already indicated that, while staff is new and not especially skilled, there should be general opportunities of

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transference open, even if they are not commonly used, so that every member of the staff can be found a post for which he has some aptitudes. Over and above this, and at a later stage, the more promising and likely members of the staff should be exchanged from department to department, with the express intention of widening their experience and enabling them to realise what transport means as a whole. I am glad to be able to record many examples of this selective interchange of staff. Perhaps the most clearly formulated scheme that I have noticed is that of the Great Central Railway, known as the Higher Grade Examination Scheme, because entrance to it is based upon the result of a competitive examination. The Higher Grade Apprenticeship Scheme of the London and North Western Railway is somewhat similar. The North Eastern Railway, like my own companies, has a cadet system by which members of the staff are recruited for practical training from among those who have had the good fortune to enjoy an advanced education. The differences in the schemes adopted and in the methods tried represent the diverse thoughts of many people seeking to solve one problem, the provision of an adequate number of chief clerks, assistants, inspectors, supervisors, and so forth, from which to select capable officers and managers. Others may be able to speak to you more authoritatively about the results of these endeavours; I only want to suggest to you here that an exchange of experience might help a long way towards a generally approved scheme such as this Institute might recognise, and all might adopt.

The second stage is more difficult. There should be some exchange of staff between undertakings. There is something educative in a mere change of circumstances. It provokes new adaptations out of which progress springs. The best that happen to-day are visits of inspection. In my own companies, for instance, we have definitely taken up the policy of sending our officers and expectant officers to investigate and report upon traffic conditions in other metropolitan cities. Some went to New York and other American cities, last year. Some went to Paris this. There is no question but that visits of this sort afford refreshment of mind and outlook, and are beneficial to the temper in which the work of the undertakings is conducted. More than this is wanted, and a scheme for the exchange of staff might not be impossible of establishment. It is capable only of a limited extension, but to whatever limit it is found practicable it ought to be tried. This exchange between two undertakings of a similar type is more easy than between two dissimilar undertakings, yet it is the latter that promises the greater value. I would like that we should realise the solidarity of transport. There is a sense in which, for example, the competition of motor road traffic with railways seems nothing but harmful, at any rate to a railwayman, or of motor omnibuses with tramways seems nothing but harmful, at any rate to a tramwayman, but it is stimulating. The principles of transport do not alter with the means of transport, even though they look different. It is this difference in appearance that, like the variations in the natural world, affords an infinitude of interest and serves as the basis of progress. What ought we to desire better than to understand our opponent's case, his methods of working, his strength and his weakness, for only by efficiently discharging our own proper task in the world of transport shall we ultimately survive? When we realise this, some of the artificial barriers between transport undertakings will have broken down, and I have hope that this Institute may play some part in this. An exchange of staff, if it could be arranged, were the most effective weapon. Again, by the free discussion of views among ourselves, it might be possible to reach some concrete scheme for this purpose.

And education is never done. It is not once or twice that we need the provocation of an altered post, a new position. It is all our life long, if we are seeking to come out to the top and be a leader in transport. Teaching by doing is the key to business education, and the crucial point is to continue the education long enough to turn out a great man, stirring the mind to conquer ever new fields of endeavour. Our duty is to see to it that there is that environment in business which will bring out the best that is in the servants of business. If we would fix in our thoughts the idea which is literally true, that business is our university, it would transform the way in which we who now have the responsibility look at business on the one hand, and would transform the outlook and treatment of the rising staff who would one day take our places, on the other hand.

The third stage is the easiest of all. There comes a time when it seems the duty of those experienced in affairs to pause and set down the fruits of their experience. They have shared in knowledge laboriously won in the past. They must add to the store of knowledge something out of the present. Their achievements and their disappointments must have helped to clear up in their minds old principles once learnt, or to suggest new principles from which others may profit. I am happy to know that here the Institute is already active. We have an admirable series of lectures arranged for the coming session, which must assist to carry out this third stage, which I have briefly touched upon. These lectures are by way of a return for the education once received. The programme is before you. I need not mention them specifically.

This is the opening of the second year of the Institute of Transport. The birth throes are over, and it is in a flourishing state with 576 corporate members, apart from its graduates and students. It cannot fail; it can only expand. It is very fitting that now, in its early youth, it should take up this question of education. I could wish that my presidential year might be devoted to laying down a policy and developing a plan which would deal with the educational activities and aims of our Institute. I have indicated lines of approach to this task in this address. I think that probably the best manner in which this may be accomplished would be for the Institute to nominate a committee charged with the task of reviewing in detail all the steps that have already been taken, of considering what further steps can be agreed, so that recommendations may soon be placed before us which will serve to direct our efforts in right ways, enabling this Institute to take up its true position as the patron of transport and execute its purpose of attending to the training of those upon whom the great responsibility of directing transport will fall. That is my practical suggestion.

INSTITUTE OF TRANSPORT CONGRESS.

PRELIMINARY ANNOUNCEMENT.

The first congress of the Institute will be held at Manchester on Thursday and Friday, January 27 and 28, 1921. On the opening day the proceedings, in addition to official functions, will comprise two sessions, at which papers will be read and discussed as follow—

"The Development of Mechanical Road Transport," by Mr. C. le M. Gosselin, managing director, H. Viney and Company, Limited, Preston.

"Behind the Scenes in a Railway Locomotive Workshop," by Mr. J. W. Smith, locomotive works manager, Great Central Railway, Gorton.

"Roads and Road Transport," by Mr. J. Cracroft Haller, county surveyor, Nottinghamshire.

"The Problems of the Canals," by Sir John Eaglesome, K.C.M.G., general manager, Aire and Calder Navigation, Leeds.

On the second day a visit will be paid to the Manchester Ship Canal, by special invitation of the directors, and additional visits to places of interest in the vicinity will be arranged.

The congress will be open to all corporate members, graduates, and students of the Institute. A complete programme will shortly be issued, together with forms to be exchanged for the requisite congress ticket and cards of invitation to social functions.

Arrangements for the congress are being carried out by a local committee, comprising Messrs. C. Bentham (H. Simon, Limited, Manchester, etc.), W. A. M'Grath, M.B.E. (Rochdale Canal Company), and R. C. Reynolds, O.B.E. (Bleachers' Association, Manchester). Secretariat—Mr. H. E. Blain, C.B.E. (honorary secretary of the Institute), Major H. Mattinson, R.E. (civil engineer, Manchester Tramways), and Mr. A. Watson, C.B.E. (general manager, Lancashire and Yorkshire Railway), honorary local secretaries. Local headquarters, Corporation Tramway Offices, 55, Piccadilly, Manchester.

STANDARD OVERHEAD LINE MATERIAL.

Copies of the report of the joint committee of the Municipal Tramways Association and the Tramways and Light Railways Association on "Standard Overhead Line Material," the text of which appeared in our issue of August 19, 1920, can now be obtained from the secretaries of the respective associations. The report has been under the consideration of the Council of the Tramways and Light Railways Association recently, and inquiries were made as to what effect was being given to the recommendations contained therein. It was felt that after the labour expended upon the report by the joint committee, the matter should not be allowed to rest, and members are earnestly recommended in the journal of the Tramways and Light Railways Association for October to carry out those recommendations.

Copies of the report have been supplied to all the manufacturers who have applied for them. Sets of blue prints and of the sixty drawings referred to in the Appendix No. 1 are bound in book form and numbered for reference when orders are placed. Members of the association can obtain copies for the sum of three guineas.

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INDUSTRIAL COUNCIL FOR THE TRAMWAY INDUSTRY.

APPLICATION FOR INCREASED WAGES.

COMPANY REPRESENTATIVES WITHDRAW FROM THE CONFERENCE.

The National Joint Industrial Council met at the Ministry of Labour on October 26 to discuss an application from the employees, dated October 15, for an increase in wages. The application was as follows—

(1) An immediate advance to all tramway employees, aged 18 years and over, of 12s. per week upon the wages at present paid.

(2) An immediate advance upon the wages at present paid of 6s. per week for all youths under 18 years of age.

Mr. J. B. Hamilton requested the employees' representatives to state their case as fully as possible, after which the employers' representatives would retire to confer.

Mr. Cliff said that the application was a "cost of living" application, and he, Messrs. Ernest Bevin, and Robert Williams spoke in support of the application.

The parties separated at 12.45, and met again at 3 p.m., after having conferred separately.

Mr. Hamilton then submitted the following proposal—

"Before the consideration of the application by this Council is further proceeded with, the secretaries be instructed to obtain full information and report upon the following points at the earliest possible moment—

(1) The increased cost of living compared with the increased wages or bonuses paid to the various classes of tramway employees.

(2) A comparison between the wages paid to the various classes of tramway employees and other classes of comparable occupations.

(3) The present financial position of the various tramway undertakings with the object of ascertaining—

(a) The increased costs of operation, and

(b) The result of the increased charging powers that have been put into force.

It was to be clearly understood that this offer of further consideration does not in any way commit this Council to recommending the acceptance of any portion of the application submitted to-day."

Mr. C. G. Tegetmeier followed, and said that at a special meeting of tramway company representatives held at Caxton Hall on Friday, October 22, the following resolution was passed—

"Resolved that it is impossible to enter into any negotiations with the unions represented on the National Joint Industrial Council, which may result in increased wages being paid to the tramway employees."

Mr. Bevin inquired whether the policy of the companies was to be that they would decide upon such an application before hearing the case of the employees.

Mr. Tegetmeier replied that owing to the financial position of the companies, and the recent increases in the pay of tramwaymen, together with the fact that the Tramways (Temporary Increase of Charges) Act, 1920, had not become effective, and in many cases not operative, they were unable to entertain any application involving an increase of wages. He pointed out that further investigation into the finances of the various undertakings at the present time was unnecessary, having regard to the fact that a complete investigation took place in March last.

In view of their inability to negotiate on the matter, the company representatives withdrew from the meeting.

After further discussion between the Municipal Employers' representatives and the employees' representatives, the parties conferred separately, and resumed at 5 p.m., when Mr. Bevin submitted the following statement—

"We are prepared to appoint, jointly with the representatives of the Municipal Tramways Association, a committee to investigate all the facts relevant to the wages application."

"We are not prepared to make wages dependent on the financial condition of the respective undertakings, but adhere to the principle that we are entitled to advances comparable with the admitted increases in the cost of living. We further reserve the right to make a claim that the increase shall be dated back to a period not later than the date of the application, and hereby agree to this meeting being adjourned to November 12 next."

The meeting then terminated.

The Council met as arranged on November 12, but for the convenience of both sides the Conference was again adjourned to November 17.

London Traffic Authority.—Sir Eric Geddes has announced that a Bill is being drafted with the object of setting up a London Traffic Authority.

"EXCESS" OR NEW FARE.

IMPORTANT POINT WHICH MAY BE TAKEN TO HIGH COURT.

A tramcar passenger contested, at the West London Police Court the contention of the London United Tramway Company that when a passenger travels beyond the distance for which a ticket has been taken a new fare, and not merely "excess," is payable. Mr. Spiller, an architect and surveyor, boarded a tram car at Turnham Green, paid 1½d., which entitled him to travel to Ravenscourt Park, then went on to Hammersmith. The conductor demanded another 1½d., and Mr. Spiller tendered ½d., which would bring his full payment to 2d.—the charge from Turnham Green to Hammersmith.

The conductor insisted on 1½d., and Mr. Spiller was summoned because he refused to pay. His argument was that if he went beyond his ticket on a railway he would be required to pay the excess only; he had done so on the Metropolitan Railway.

For the tramway company it was argued that the original contract ended at the point to which travel had been paid for—in this case Ravenscourt Park—and that by continuing the journey a new contract had to be made from that point to the place of alighting.

Mr. Leycester, the magistrate, in ordering Mr. Spiller to pay 10s. costs, said he was surprised the point had not been raised before. He was not at all certain of the conclusion to which he arrived—that "additional fare" was the additional amount payable according to the rules and scheduled prices of the tramway company—and added that he would be glad to state a case for the consideration of a higher court.

SOUTHAMPTON TRAMWAY DISPUTE.

MANAGER'S ACTION JUSTIFIED.

At Southampton Corporation tramway offices, on October 13, a committee, consisting of Councillor C. Higham (chairman of the Blackburn Corporation Tramways Committee) and Mr. Stanley Hirst (Secretary of the Amalgamated Association of Tramway and Vehicle Workers), appointed by the National Joint Industrial Council, considered the case of a conductor whose dismissal caused the recent strike. The case for the Corporation was submitted by Mr. J. Dobson, general manager of the tramways, and for the man by Mr. Allen, district organiser of the United Vehicle Workers.

After an investigation lasting five hours, the committee gave the following decision—

"We are of the opinion that the general manager was justified in dismissing conductor Hendley, it having been proved that Hendley, in his reply to Inspector Gear, agreed to work on Bank Holiday. In regard to the question as to the notice given to conductor Hendley that he should work on Bank Holiday, August 2, we cannot satisfy ourselves, owing to the conflicting nature of the evidence, whether the requisite seven days' notice was or was not given. Under these circumstances we strongly recommend that conductor Hendley be re-started forthwith without any back pay."

GLASGOW TRAMWAYS FINANCE.

A VANISHING SURPLUS.

An interesting financial statement relating to the Glasgow Corporation Tramways was made by Councillor Kelly, convener of the tramways committee, at a luncheon held after an inspection of Pinkston power-station, where they were received by Mr. James Dalrymple, general manager, and shown over the various departments. Councillor Kelly, convener of the department, said the revenue from the change in fares had exceeded their expectations, and it was well that it had, because the expenses of running the department were still on the up grade. For the first three months of the present financial year—from June 1 to August 31—revenue amounted to £559,770, and the expenditure to £444,585, leaving a balance of £115,185, but after all deductions were made the actual surplus was only £3,915.

They expected further demands on the revenue, which would amount to no less than £250,000, and if these were granted they would have a miserable surplus of something like £12,000 to hand over to the common good. While they were willing and anxious to employ their men at the highest rates, there was a limit. If they could not keep within the limits of revenue they must find more revenue, and there was only one source from which it could come. That was a further increase in tramway fares.

Mr. Dalrymple, in reply to the toast of "The Staff," proposed by Councillor Montgomery, said there was just one work at present to which they had to give all their attention—that was to maintain the capital investment in the tramways undertaking. The citizens of Glasgow had invested £4,000,000 in the undertaking. They could not have extensions and improvements so long as they were not able to keep the system as it was to-day. Before they could launch out and spend more money they must see that the undertaking was kept in an efficient and proper manner.

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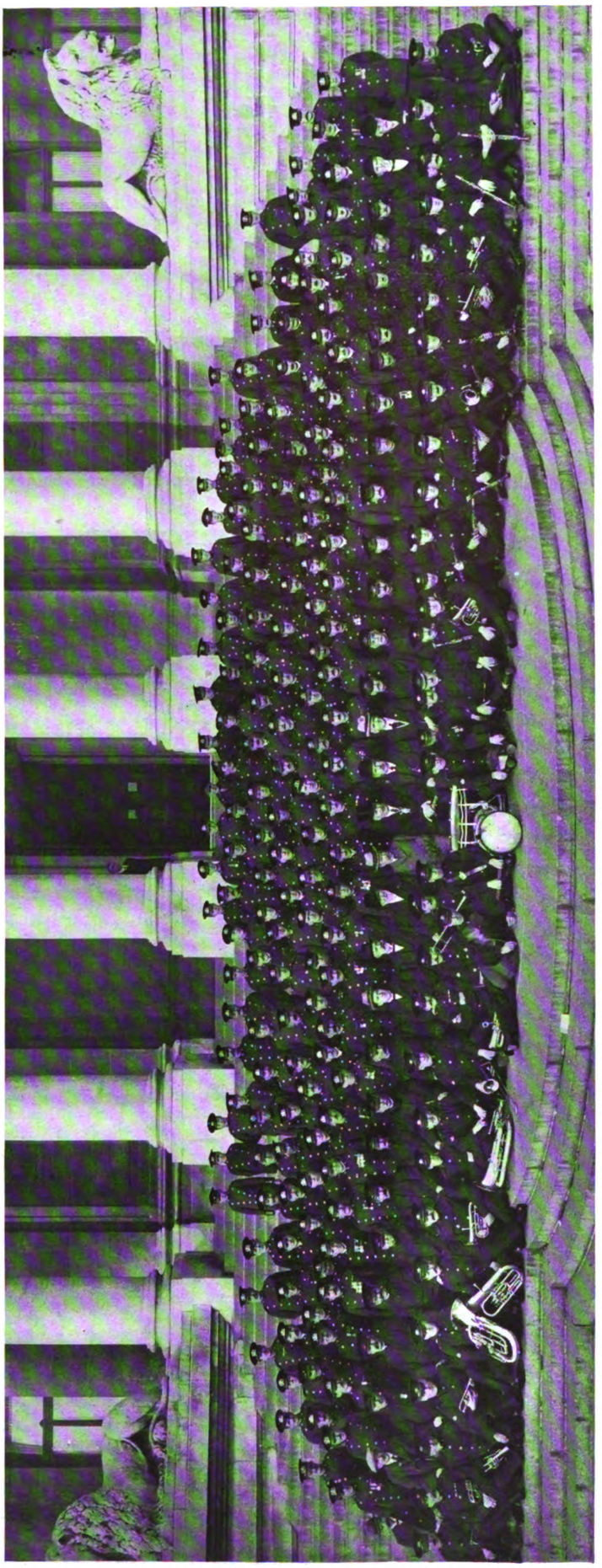

Portsmouth Tramway Men and the Borough Police Photographed at the Town Hall.
In the Centre The Mayor (Councillor J. Timpson), Chairman of the Tramways Committee; on his right, Mr. W. R. Spaven, the Tramways Manager.

PORTSMOUTH TRAMWAY MEN'S CHURCH PARADE.

BROTHERHOOD v. STRIKES.

The accompanying illustration commemorates a very interesting occasion in connection with Portsmouth tramways. Some 250 tramwaymen and a like number of the borough police took part in an impressive church parade on Sunday, October 24. It will be remembered that before the war the religious and social movement represented by the Tramways Brotherhood, which had originated at Kennington in London, had achieved a great deal of success among tramway employees in different parts of the country. The Portsmouth parade was a revival of the annual ceremony of the local branch of the Brotherhood. In the morning the tramwaymen, with their band, assembled at the Town Hall, from the steps of which they were photographed, with the Mayor (Councillor John Timpson, J.P.), Alderman Power, Alderman Payne, Councillor Walter Ward, Mr. W. R. Spaven (tramways manager), and the tramway inspectors. A large number of people were abroad to witness the parade. After an inspection by the Mayor, the men swung with martial bearing in fours, down Commercial Road to North End, where the service was held at St. Mark's Church. The borough police and firemen had paraded in strong numbers at North End, and marched to the church.

There was little room for any but the tramwaymen and police in the church. The tramways band occupied the choir stalls, and supplemented the organ in providing music for the service. The Rev. Lionel E. Blackburne, Rural Dean, and president of the Tramways Brotherhood, conducted the service.

The Rural Dean, who based his address on the words, "Ye are brethren; why do ye wrong one another?" in the course of his remarks, said—A church parade is a recognition of the fact that human life in its many relationships suffers loss if that which religion stands for is left out of account. I think of religion in its simplest and truest form as being the acknowledgment of the two great principles of the Fatherhood of God and the Brotherhood of Man. We cannot regard the world as it is to-day without being painfully aware that it stands in dire need of these very principles. Besides national wars there are class wars growing in bitterness and intensity. If such a state of things continues much longer there can be nothing for it but widespread ruin and disaster. If men in various classes cannot learn to try to understand and trust each other, then they will die at each other's hands. But that is only to say we need to remember that God is our Father and we all are brethren. I would ask you to consider the grave problem which has arisen in the last week in our own country. The miners' strike is merely the employment of force of a particularly ruthless kind in order to gain an end. Now, even if the end is a just one, the means chosen to attain that end is unjust, for the effect of a strike is to cause suffering, not to those who withhold from the miner his extra wage, but to the whole community; to the poorest and weakest the greatest suffering. Now, this seems to me to be a flat denial of brotherhood and a flat denial of true democracy, which, as I understand it, is the brotherhood of men in the realm of politics, and that is why I am a believer in democracy.

I stoutly therefore protest against the use of force to effect that which could be done by constitutional means.

It is said that the capitalists have abused their power. I do not deny it. But what of that? Can two blacks make a white? Will you build up a better England out of the abuse of the power of a vast trades union than you have done out of the abuse of power by a few capitalists? How is it that men are so blind? You cannot defeat selfishness by selfishness; anger will never cure anger. It is only in a spirit of brotherhood that our national troubles will be solved, and I see the spirit of brotherhood being more and more banished from our land.

If the miners have a quarrel, the other members of the great trades unions have none, and it can only be

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from motives dreadfully like those of Germany in 1914 if they join in this quarrel. A restricted sense of brotherhood, a severely limited power of sympathy is impelling them. They think they must be loyal to their partners in what is called the Triple Alliance (a name of sinister import in the light of modern history).

Now I plead for a higher, a wider sense of brotherhood. If this great strike is to come, there can only be one result, women and children will suffer the most. I call upon you to pray to the great Father of us all that He will teach us to stay our strife, and learn to love where now we hate, to tolerate where now we condemn, to live as brothers where we now strive together as enemies.

UNDERGROUND RAILWAYS AND L.G.O. CO'S EFFICIENCY MEETINGS.

The London Underground Railways and London General Omnibus Company, operating department, resumed the series of efficiency meetings (6th session, 1920-21) on Thursday, October 28, 1920, in the Cinema Hall, L.G.O.C., Training School, Milman's Street, Chelsea, S.W. Mr. H. E. Blain, C.B.E., operating manager, presided. A paper entitled "Some Phases of Transport of the Future" was read by Mr. L. Findlater, superintendent of employment, training, and catering, L.G.O.C., which was much appreciated by over 320 of the supervisory grades who were present. The points dealt with included era of speed, Kearney high-speed railway, gravity railways, mono rails, post-office tube railway, transport by air, safety, carrying capacity, comfort, regularity of service, cost, deep level high speed lines. The discussion was opened by Mr. A. V. Mason, deputy manager and engineer of the London United, South Metropolitan, and Metropolitan Electric Tramway Companies; Mr. H. Winkworth, experimental assistant, Underground Railways; and Mr. T. Mack, of the office of the general superintendent, L.G.O.C. A vote of thanks proposed by Mr. Murray Griffith (director of the District Railway), and seconded by Mr. C. J. Spencer (general manager of the tramways group), brought an interesting and instructive evening to a close.

HINTS FOR TRAMWAYMEN.

The London "Safety First" Council have issued another practical poster of "dont's" addressed to motormen and conductors of electric tramcars. The twelve points on the poster, which points out that 41 persons were killed and 3,000 injured by electric tramcars in the metropolitan area in 1919, are—

(1) Never drive too close to moving traffic.

(2) Do not attempt to pass traffic until you are sure it is clear of the track.

(3) Drivers should not look to the rear when the car is in motion, but always look ahead.

(4) Never allow car to "drive itself," but always retain control.

(5) Do not start car before you get conductor's authorised signal.

(6) Make sure that facing points are properly set, and remember that the maximum speed at such points is four miles per hour.

(7) Do not start or stop your car with a jerk.

(8) Proceed cautiously where the track or overhead equipment is defective or under repair.

(9) Do not assume that a pedestrian in the road is aware that your car is approaching, but make sure.

(10) Never pass signals at danger.

(11) Do not fail frequently to test your sand and brake gear; they are the motorman's best friends.

(12) Do not allow trolley rope to swing loose.

Date of Termination of War.—In reply to a question in the Commons, Mr. Bonar Law said the Termination of the War (Definition) Act, 1918, provides that the date of the termination of the war shall be as nearly as possible the date of the deposit of ratification of the last treaty of peace. There would be no unnecessary delay in the ratification of the Turkish and the Hungarian treaties, which are the last two outstanding treaties to be ratified.

North Eastern Railway Electrification.—The North Eastern Railway Company intends to promote a Bill in the forthcoming session of Parliament to include powers to electrify the main line from York to Newcastle and the line from Northallerton to Stockton-on-Tees. It is proposed to use the third-rail system for sections of the line between stations and overhead wires at stations and busy junctions. Electric locomotives will be employed at important yards for shunting, as in the case on the Newport and Shildon mineral line.

TRAMWAY AND LIGHT RAILWAY NOTES.

BARROW.

A Futile Boycott.

An endeavour to reintroduce penny fares on the tramcars was made at Barrow Town Council recently. It was stated that on some of the short stages the trams were being boycotted. Councillor Thompson replied that if the number of passengers carried was less the revenue was increasing. The boycott was also falling off. A motion to reintroduce penny fares was lost.

BIRMINGHAM.

Success of New Minimum Fare—Free Riding for Disabled Men.

Mr. Alfred Baker, general manager of Brimingham Corporation Tramways, has reported to the Tramways Committee that the last increase in tramway fares, which came into operation in June and established the 1½d. minimum fare, has so far as can be ascertained about realised the estimates of the department. The Tramways Committee have granted the privilege of free riding to discharged and demobilised soldiers, sailors, and airmen suffering from leg injuries sustained in the war, if sufficiently serious to impair their ability to walk. Passes will be issued to eligible men, who must apply on a form to be supplied by the tramways department. Each application must be accompanied by a certificate of a physician or surgeon setting out the measure of the men's disability. Free riding will be limited to residents of the city. For some time the blind have been permitted to ride free on the Corporation cars.

BRADFORD.

Rail Delivery in Twelve Months.

According to the *Bradford Daily Telegraph*, new tramway rails are on order for the city, but it is probable that 12 months will elapse before they are delivered.

BRIGHTON.

Special Fares for Race Days Criticised.

Although such matters do not come within the scope of the Profiteering Act, the Brighton Profiteering Committee has censured the Brighton Corporation for charging a shilling fare on its tramcars during Brighton races. The Mayor said the cars on the route were run at a loss for 300 days in the year.

BRISTOL.

Workmen's Fares Wanted on all Cars.

Bristol Corporation have decided to endeavour to make arrangements with the Bristol Tramways and Carriage Company, Limited, for the grant by the company of workmen's tickets to all workmen travelling to and from their work at any time of the day or night while the cars are running, and that similar facilities be accorded to all children of school age.

BURNLEY.

Car Runs Backward.

A tramcar was proceeding along Manchester Road, Burnley, when after a stop it began to run backwards down a steep gradient. The driver was unable to pull the car up until it had travelled about 200 yards, and it was then found that the brakes were out of order. A woman passenger, in attempting to alight, fell to the ground, and suffered from concussion.

COLNE.

Delay in Delivery of Cars—Purchase of Omnibuses.

At a meeting of the Colne Council, Mr. Knight said that the Tramways Committee had placed an order for two bogie cars, but owing to the number of orders the makers had in hand, delivery could not be expected for a considerable time. In order to ease the traffic conditions it had been decided in the meantime to purchase three second-hand motor omnibuses at a cost of £700 each. This would help to link up the outlying districts.

CROYDON.

Extension of Tramways Depot.

The Tramways Committee propose to enlarge Purley tramway depot at an expense of £11,400. Councillor Thomson, chairman of the committee, stated at the last Council meeting that accommodation for 20 cars was needed, and the work proposed would extend over 12 months. He believed there was a future for tramways, and hinted at the need for extension and further powers generally. Alderman Fox pointed out that the undertaking lost £17,000 last year, and he advised that the results of the latest increase of fares should be awaited. The recommendation was referred back to the committee.

DONCASTER.

Increased Fares

Doncaster Corporation has received the authorisation of the Ministry of Transport to increase the fares, and the increase took place on October 10.

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GLASGOW.

INCREASED PAY OF EMPLOYEES—SALE OF TRAMWAY TOKENS.

The terms accepted in the middle of October by the Glasgow tramway employees in present satisfaction of their demands include an advance of 4s. a week to men and 2s. to women, made retrospective to June 1, a provision that the maximum wages be reached in four years instead of seven, and that other claims be reconsidered in January next. The employees, who are members of the Municipal Employees' Association and the United Vehicle Workers' Union, had asked for a minimum wage of £4 for those 18 years of age and over, and for the full terms of the national agreement made in March last. At one time it appeared inevitable that a strike would take place; but conciliation and compromise secured a peaceful issue out of the difficulty, at least for the time being. The Glasgow Tramways Department have recently placed on sale the red discs which were originally intended for the two-stage tokens. As the manufacturers could not supply a sufficient quantity of celluloid for the time being, the management issued paper coupons, which have proved popular. Indeed, so convenient are these slips and booklets that it is doubtful if the celluloid tokens will "catch on." Meantime it is intended to stock both varieties.

GREENOCK.

Mr. J. Dalrymple and Mr. J. B. Hamilton, general manager of the Glasgow and the Leeds Corporation Tramways respectively, met the members of the Greenock Corporation's Tramway Committee on October 1, in response to a request for fuller information regarding certain points of the report they recently made to the Council following an inspection of the system from Gourock to Port Glasgow.

HALIFAX.

FREE RIDES FOR THE DISABLED.

Halifax Corporation Tramways Committee is the latest authority to grant disabled ex-service men the privilege of riding free on the tramcars.

HUDDERSFIELD.

NEW CARS TO BE BUILT—POSTMEN TO PAY ORDINARY FARES.

Owing to the high price of tramway cars, Huddersfield Council have authorised Mr. A. A. Blackburn, the general manager, to build cars in the Huddersfield shops. New machinery has been obtained for the equipment, and when the new depot in St. Thomas' Road is completed, space will be prepared at the Great Northern Street depot for the erection of a workshop. Mr. Blackburn, while rolling stock superintendent at Belfast, was responsible for the construction of cars in that city. Postmen at Huddersfield now pay the ordinary tramway fares. Previously they were able to travel at reduced fares, but the Tramways Committee felt that such an arrangement could not be continued as it entailed a loss to the tramway undertaking at present prices of several hundreds pounds yearly. The postmen will now give celluloid tokens in payment instead of paper coupons, which will be a great convenience to the conductors.

HULL.

ADVANTAGES OF THE FRONT EXIT—FREE PASSES FOR OLD AGE PENSIONERS—NEW TRAMWAY OFFICES.

Mr. E. S. Rayner, general manager of Hull Corporation Tramways, has stated to the Tramways Committee that he thinks it would improve the service and save time if they could discharge passengers at the front end of the cars, leaving the back free for people to board the cars. It would obviously save much time. One of the Hull by-laws requires, however, that passengers must leave at the rear end, and it is suggested that the by-law should be amended. The "front exit" is an improvement strongly advocated in these columns since 1909, but there are few industries more conservative than that of tramways. The issue of free passes enabling old age pensioners in Hull to travel on the Corporation's tramcars has come into operation. There are 5,000 persons eligible. The possession of a pass permits the holder to travel free of charge only between the periods 9.30 a.m. to 11.30 a.m., 2.30 p.m. to 4 p.m., and from 7 p.m. onwards in each day; at all other times the ordinary fare must be paid. Passes do not entitle the holders thereof to make two consecutive journeys in the same tramcar, to ride except when there is seating accommodation, nor to ride on the upper deck. The acceptance of a pass is regarded as an agreement indemnifying the Corporation against any accident or injury to the holder whilst on the cars. Hull Corporation has decided to offer £10,000 for disused Turkish baths for conversion into tramway offices.

LLANDUDNO.

TRACK RELAYING AND REPAIR.

The tracks of the Llandudno and Colwyn Bay electric railway were recently inspected on behalf of the Ministry of Transport by Colonel Pringle, who suggested certain improvements, including the relaying of the lines in Gloddaeth Avenue. The Council have called upon the company to execute the work as soon as possible.

LANCASTER.

FAILURE OF MAGNETIC BRAKE.

At an inquest at Lancaster on Thomas Stackhouse, a pedestrian, who was killed by a runaway tramcar, Major G. C. Milnes, electrical engineer to the Lancaster Corporation, and Mr. Joseph Parkinson, chief electrical engineer at White Cross Mills, both expressed the opinion that the accident was due to the failure of the magnetic brake. Major Milnes said usually careful inspection would bring the defects to light, and Mr. Parkinson also said he thought careful examination of the brake parts would eliminate most of the risks of such a failure. In returning a verdict of "Death from misadventure" the jury added a rider that there should be stricter supervision exercised regarding the need of repairs to cars.

LEEDS.

TRAMWAYMEN'S BACK PAY.

When the recommendation of the General Purposes Committee to give an increase of a farthing an hour to the tramway employees, to date from September, was considered by the City Council, Alderman H. Brown moved an amendment referring the matter back to the committee, claiming that the increase should date from March 29. Alderman R. A. Smithson, chairman of the Tramways Committee, in opposing the amendment, said that if there had been any mistake it was in granting the increase, because they were going beyond the national agreement. Despite a strong protest by Alderman C. H. Wilson, who declared that the men were perfectly satisfied to receive the increase as from September, the amendment was carried.

LEITH.

TRAMWAY OFFICIALS AND STAFF TO BE TAKEN OVER BY EDINBURGH CORPORATION.

In connection with the Edinburgh-Leith amalgamation scheme, the administrative staff of the Leith service, as well as the tramway drivers and conductors, will be taken over on the same conditions as those under which they are working at the present time. The higher officials will be retained at the salaries received prior to the August increases in Leith.

LONDON.

OVERHEAD TROLLEY SYSTEMS SANCTIONED—AN EFFECT OF CHEAP FARES—NEW TRAMWAY CONSTRUCTION.

The Minister of Transport has consented to the use of the overhead trolley system of electric traction on that portion of the London County Council Tramways in Grove Road, Burdett Road, and West India Dock Road. The work will be begun shortly. Lunch hour traffic on the Council's tramways has, it is stated, increased since the introduction of the 2d. all-the-way fare. This is condidered to be due to the fact that a larger number of city workers who live within 30 minutes' ride now return to their homes for luncheon. The construction of the tramway from West India Docks to Terrace Road, Hackney, *via* West India Dock Road, Burdett Road, Grove Road, Lauriston Road, and Well Street has been begun by the Consolidated Construction Company, Limited, on behalf of the London County Council. The tramway will link up directly the boroughs of Poplar and Hackney.

MANCHESTER.

MOTOR TRAFFIC AND TRAMCAR PASSENGERS—ROAD RIGHTS OF A TRAMCAR.

The proposal in the Manchester Corporation's Parliamentary Bill which provides that all vehicular traffic that would otherwise pass a stationary tramcar while unloading its passengers shall stop until the road is clear is objected to by the Team Owners' Association of the city. The clause, they state, would make congestion worse than ever. The Watch Committee have decided, however, to retain the clause in the Bill. The chairman of the Manchester County Justices fined the driver of a motor van £2 and £3 1s. 6d. costs for driving to the danger of the public, and stated that as the driver of a lighter vehicle it was defendant's duty to give the right of the road to the driver of a tramcar. Defendant's offence was that of driving sharply out of a side street and crossing immediately in front of a moving tramcar, the driver of which only averted an accident by the prompt application of the brakes.

NOTTINGHAM.

SPECIAL RACE FARES.

On October 4 for the first time a special fare of 6d. was charged on special cars run by Nottingham Corporation for the races. As the drivers and conductors on the cars have to be paid overtime at the rate of time and a quarter and time and a half, which Mr. J. Aldworth, the general manager, states works out at over 2s. an hour, the Tramways Committee found it necessary to institute the special fare.

ROTHERHAM.

ITEMS OF PARLIAMENTARY BILL.

The Tramways Committee propose to seek Parliamentary powers to increase the weight of railless electric vehicles, to increase fares

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to 2d. per mile, to amend the conditions as to running of workmen's cars, and to extend the motor omnibus service beyond the existing tramway routes.

SHEFFIELD.

Sports Ground for Tramwaymen.

The Sheffield Corporation Tramways Committee have purchased a large area of freehold land on the fringe of the city boundary between Woodseats and Norton for the purpose of a sports ground for the 2,700 employees of the tramways and motor department. Close upon 2,000 of the employees have already intimated their intention of joining the sports club and contributing each week to the club funds. It is intended to provide for cricket, football, tennis, bowls, and various other branches of sport, and every employee of the department is entitled to become a member of the club.

STRETFORD.

Requests for Improved Service and Queues.

Stretford Urban Council have asked the tramway authorities to give an improved continuous service at Trafford Park, and also to adopt the queue system at all congested points throughout the district. A representative meeting of employers and employees in the Trafford Park industrial area has expressed dissatisfaction with the transport facilities and "the disgraceful condition of the roads."

SOUTHEND-ON-SEA.

Rails from America.

The borough engineer, Southend-on-Sea, recently wrote to Glasgow Corporation Tramways Committee regarding the contract for steel tramway rails recently placed by the tramways department with the United States Steel Products Company, and asking if it would be possible for the department to place an additional order under their specification for a supply of rails for Southend Corporation. The committee, having heard the manager, agreed to recommend that no action be taken

TORQUAY.

Cost of Energy.

It has been decided to ask the Ministry of Transport to appoint an arbitrator to decide on the price of current to be paid by the Torquay Tramways Company.

BUSINESS NOTICES.

Siemens Brothers and Company, Limited, and Siemens Brothers' Dynamo Works, Limited, will shortly remove their head office from Caxton House to Westminster, S.W.

The British Electrical and Allied Industries Research Association has now been incorporated, and the registered address is 19, Tothill Street, London, S.W.1. The Director of Research is Mr. E. B. Wedmore.

The Portland Cement Works, of Singapore, require an electrician engineer. The salary offered is from £650 to £700, with a free house on site and participation in bonus. Applications should be addressed to Messrs. C. and C. Lindsay and Pierce, Hope Street, Glasgow.

The Shrewsbury and Challiner Tyre Company, Limited, have opened a new solid tire fitting depot in Haymarket Lane, Newcastle-on-Tyne. The depot has been fitted with the most modern plant and appliances to ensure expeditious fitting, and the necessary plant for the removal of wheels from steam wagons of various makes has also been installed. The depot is under the direction of Mr. A. F. Bell.

Mr. L. E. Little, founder and managing director of the Northern Ball Bearings Company, Limited, has severed his connection with that Company and has joined the Ransome and Marles Bearing Company, Limited, and is at present engaged in introducing several new features in ball bearing design. His headquarters will be at the company's London office, 64, Mortimer Street, Great Portland Street, W.1, where large stocks of English and metric sized bearings will be carried.

English Electric and Siemens Supplies, Limited.—We are informed that an amalgamation has been completed of the English Electric Supplies, Limited, and the lamp and supplies department of Messrs. Siemens Brothers and Company, Limited, and as from November 1 the business will be carried on under the title of English Electric and Siemens Supplies, Limited, with registered offices at 191 and 192, Tottenham Court Road, London, W.1. The supplies department, with showrooms and stores at 38 and 39, Upper Thames Street, London, E.C.2, will be retained, and all orders and business in connection therewith will be dealt with at that address. The same staff is being retained both in London and at the branch offices. The new company will carry on the business of both companies with the same products, and new electrical devices will shortly be placed on the market.

PERSONAL.

Mr. R. H. Nuttall, car shed superintendent of Doncaster Corporation Tramways, has been granted an increase in salary to £300 per annum.

Mr. T. Wilkinson, who is the chairman of the Lancaster Tramways Committee, has been selected as Mayor of Lancaster. He has been a member of the Council since March, 1901.

Lieut.-Colonel A. C. H. Kennard has been appointed a member of the highways committee of the London County Council in place of **Major Sir Philip Dawson,** who has resigned.

Mr. O. G. C. Drury, assistant engineer of the London, Brighton and South Coast Railway Company, has been appointed engineer of the company in succession to the late Sir James Ball.

Mr. Albert Peech has been appointed chairman of the United Steel Company in the place of the late Mr. Henry Steele. Mr. Herbert Guedalla has accepted the vacant seat on the board.

Mr. Arthur Kent has resigned the position of cable works manager of the Hackbridge Cable Company, Limited. Communications should be addressed to him at The Hollies, Belmont Road, Surrey.

Mr. H. R. Docker, time-tables assistant of the London County Council tramways, has been appointed assistant divisional traffic superintendent, at a salary, including temporary allowances, of about £500 a year.

Mr. Dudgeon, line superintendent of Birmingham Corporation tramways, has been retained by Wolverhampton Corporation to assist in the conversion of the Lorrain surface contact system to the overhead system.

Sir Philip Lloyd-Greame has retired from the board of the Anglo-Argentine Tramways Company on accepting office as Parliamentary Secretary to the Board of Trade. **Sir Edward Goulding** has been elected a director of the company.

Mr. James Caldwell, technical director of several electric welding concerns, and deputy chairman of Industrials, Limited, has retired from the firm of Messrs. J. E. Sayers and Caldwell. His address is now 14-16, Cockspur Street, and Parliament Mansions, S.W.1.

Mr. G. Potter has been promoted to the position of time-tables assistant of the London County Council tramways, at a commencing salary of £250, rising by annual increments to £300 a year (pre-war scale). The present salary, with allowances, is about £464 a year.

Mr. H. W. Laing has been appointed by the St. Anne's Council as manager of the Blackpool, St. Anne's and Lytham tramways from November 1. On that date the lines become the property of the Council. Mr. Laing has hitherto been manager of the Blackpool, St. Anne's and Lytham Tramways Company, Limited.

Alderman A. Fawcett has resigned the chairmanship of the Halifax Tramways Committee, and has retired from the Corporation. He was an original member of the committee, which was organised twenty-four years ago, and for some time past has been vice-chairman. Last year he succeeded the present mayor as chairman.

Alderman F. A. Dunsford has been re-elected chairman of the Southampton Corporation Tramways Committee. He has held that position ever since the undertaking was acquired from the old Southampton Tramways Company in 1898, and during his chairmanship great strides have been made in tramway development in Southampton.

The Liverpool Tramways and Electric Power and Lighting Committee, on October 15, passed a cordial vote of thanks to the chairman, **Mr. Frank C. Wilson,** who is at present in America. Mr. Wilson took up the chairmanship of the committee at a difficult time, and while in America is taking the opportunity of studying tramway and electrical supply methods there.

Mr. J. P. Crouch, general manager of the Metropolitan Carriage and Wagon Company, Limited, Birmingham, has been appointed by the Highways Committee of the London County Council to act with the general manager, Mr. A. L. C. Fell, as assessor of the prize designs for tramcars, which the Council invited by advertisement issued on June 26, 1920, to be submitted by November 1.

Sir Thomas Baker has been appointed chairman of the Plymouth Corporation Tramways Committee. Alluding to his acceptance of the position, the *Western Mercury* said that it required a man who puts public interest before his own comfort to tackle the huge problem presented by tramway administration in Plymouth. Sir Thomas will certainly look at the tramways in a purely business light, and if the Council will do the same all will be well.

Mr. Alfred Arnold Remington has joined Karrier Motors, Limited, of Huddersfield, as a director. He will have as his particular branch the interests of the technical side of the business, and will design and supervise the construction and production of the "Karrier" commercial lorries. Mr. Remington for the past nineteen years has been associated with the Wolseley Motor Company, Limited, having had charge of the design and production of their chassis.

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Dr. Walter Rathenau, head of the A.E.G. of Berlin, who desired to attend a three days' international conference on trade which was held in London recently, was prohibited under the Aliens Act of 1919 from landing in England. Dr. Rathenau, while ostensibly promoting the cause of international peace before the war, was actively engaged at the same time in promoting the German preparations for war, and was understood to be in favour of the German policy which looked toward a war with this country.

Councillor John Timpson, chairman of the Portsmouth Corporation Tramways Committee, has been unanimously elected mayor of Portsmouth for the third time. Sir Harold Pink, in proposing the election of Councillor Timpson, said that they wanted a man who was in favour with the Government and the naval and military authorities, one who was wise, strong, and not afraid to express his opinions. Councillor Brewis, who said the town was proud of Councillor Timpson, paid a high tribute to the manner in which the mayoress had assisted her husband and carried out her part of the civic duties.

Sir John W. Courtis.—At a private meeting, on October 26, of representatives of municipal tramways on the Industrial Council, Sir John Courtis stated that he was retiring from the Cardiff City Council, and that that was the last meeting of the Industrial Council that he would attend. The announcement was received with much regret, and Messrs W. J. Squires, J. B. Hamilton, J. M. McElroy T. B. Goodyer, and Alderman W. G. Wylie made remarks expressing cordial appreciation of the valuable services rendered by Sir John during his long connection with municipal tramways. Sir John was present at the first meeting of the Municipal Tramways Association in Glasgow, and he has always taken a warm interest in everything that concerned the development of municipal tramways. After being a member of the Cardiff Corporation Tramways Committee for many years, he was appointed chairman of the committee in 1910, and that office he held until his withdrawal from the City Council. He was chairman of the Municipal Tramways Association in 1919-20.

Mr. F. A. Fitzpayne, general manager of the Leith Corporation Tramways, was presented by the tramway employees, at the annual supper of the tramwaymen's Sports Club, with a dressing case, and Mrs. Fitzpayne with a handsome gold wristlet watch. Bailie Goalen, convener of the tramways committee, in making the presentation, spoke of the esteem in which Mr. Fitzpayne is held, not only by the employees in the tramways department, but by the travelling public. As convener, he testified to the valuable help he had received from Mr. Fitzpayne, and to his organising ability and business acumen. It was due to Mr. Fitzpayne's ability that the Leith tramways were a most serviceable system to the citizens and so successful financially. Bailie Goalen complimented the tramwaymen on the excellent way in which they discharged their duties. He was confident that when the Leith tramways were taken over by Edinburgh the employees would hold their reputation for smartness and efficiency. In acknowledging the gifts, Mr. Fitzpayne spoke of the happy relations which had always existed between him and the men at all times, and he bespoke the same assistance that he had received for his successor when he took the reins of office.

Mr. C. E. W. Shepherd, formerly general manager and secretary of the Edinburgh and District Tramways Company, died suddenly at his residence, Devon House, Portobello, on October 18. Mr. Shepherd, who was in his 57th year, retired several years ago on account of ill-health, and was succeeded by Mr. J. D. R. Cox, who continued to be general manager of the company until the tramways were transferred to the Corporation. Mr. Shepherd was born at Plymouth, and acquired his first experience of tramways with the Manchester Tramways and Carriage Company. When this undertaking was purchased by Manchester Corporation Mr. Shepherd became outside superintendent. He subsequently went to Bradford as traffic superintendent, and in April, 1903, was appointed traffic superintendent to the Edinburgh and District Tramways Company. Later he succeeded Mr. J. E. Pitcairn, who retired after 22 years' service as general manager of the company.

Liverpool Tramways Traffic Increasing.—The receipts on the Liverpool Corporation Tramways for the first nine months of this year were £1,073,495, as compared with £858,218 in the corresponding period of last year, an increase of £215,277. In the same period the number of passengers had increased by 10,749,329.

Portrush and Giant's Causeway Tramway.—The Portrush Urban Council are discussing the establishment of an electricity supply works, and have been offered a loan of £15,000 for the purpose by the Electricity Commissioners. They have been asked to consider the question of supplying current to the Giant's Causeway Tramway Company, which is being obliged to give up its water-power stations.

CONTRACTS AND ORDERS.

Hadfields, Limited, have accepted an order for tramway rails and crossings at £6,329 from Bradford Tramways Committee.

Leeds Corporation has accepted the tender of Hugh Wood and Company, Limited, for a Jeffrey wagon loader for New Wortley works at £600.

Frodingham Iron and Steel Company were successful tenderers for 1,500 tons of tramway conductor rails for the London County Council tramways at £50,425.

J. W. Courtenay, Limited, of Amberley House, Norfolk Street, London, W.C., have been appointed sole advertising contractors for Barrow-in-Furness Corporation Tramways.

The English Electric Company's tender for a 12,000 KW. turbo-generator has been accepted by Bolton Electricity Committee. E. Green and Son are to supply three sets of economisers.

Wolverhampton Corporation have arranged with Hadfields, Limited, to carry out special work at Bakers Loop and for the special work in connection with the erection of their car shed.

Exeter Electricity Committee has recommended the acceptance of the tender of the Metropolitan-Vickers Electrical Company, Limited, amounting to £18,750, for a 1,500 KW. turbo-alternator.

Salford Tramways Committee have recommended the acceptance of the tender of Hadfields, Limited, for the supply of Hadfields' patent Era cast-steel Hecla switches (open mates and crossings) for £1,769 10s. 6d.

The Brush Electrical Engineering Company have a contract with Walsall Corporation for a 5,000 KW. Ljungstrom turbo-alternator at £46,670 for the extensions which have been sanctioned by the Electricity Commissioners.

The English Electric Company of Australia has received an order for a 25,000 H.P. turbo-alternator from the Government railway department. The machine is designed for use in connection with the electrification of suburban railways, and it is said to be the biggest unit of its kind in Australia.—Reuter's Trade Service.

Rotherham Tramways Committee have accepted the tender of Hadfields, Limited, at £1,455 for points and crossings required for the tramway extension in Frederick Street. The tender of Hadfields for points and crossings required for the renewal of the track at the junction of Westgate and Sheffield Road has also been accepted.

Edinburgh Electric Lighting Committee recommends that contracts for equipment for the Portobello power station, aggregating over £80,000, should be placed with Bruce, Peebles and Company, Limited, of Edinburgh. A contract will be placed with the Metropolitan-Vickers Electrical Company, Limited, amounting to £46,000, and another with the English Electric Company, Limited, amounting to £7,000.

The Partington Iron and Steel Company have recently placed an order with the Allgemeine Electricitats Gesellschaft, of Berlin, for electrical plant worth approximately £200,000. The plant will consist of two 1,400 KW. generators and a 3,000 H.P. motor for direct coupling to a reversible rolling mill. It appears that the price was very little, if any, lower than the apparatus would cost if the contract had been divided and the order for different portions placed with British firms. The Partington Company, however, seem to have objected to the price adjustment clause now usual in British contracts, which provides for revision of the price in case of any alteration in the cost of the material required, or any alteration in wages. This uncertainty is undoubtedly proving a serious detriment to British trade, but it is difficult to see how it can be avoided at the present time, and it is surely the duty of British firms who expect to make their profits mainly in this country to consider very carefully whether they are justified in placing orders abroad, particularly where the difference in price is not great.

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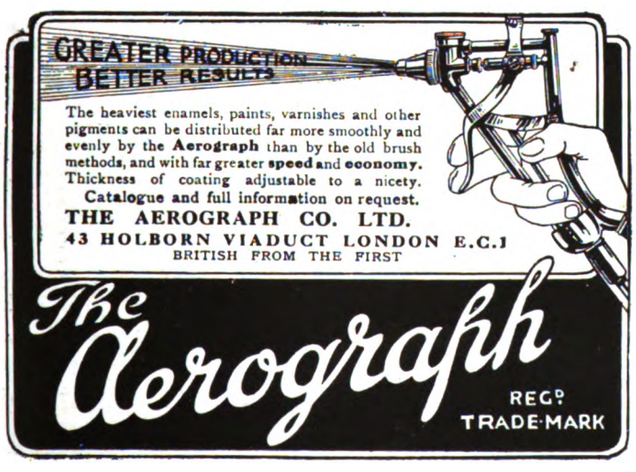
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PATENT LIST

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Gas fuel containers for motor vehicles (28,006)—M. F. L. A. Aymard.
Differential mechanism for vehicles (27,448)—M. J. B. Barbarou.
Clutch devices for motor vehicles (27,450)—M. J. Barbarou.
Steering devices for motor vehicles (27,451)—M. J. B. Barbarou.
Rear axles for motor vehicles (27,452)—M. J. B. Barbarou.
Direction indicators for motor vehicles (27,855)—E. J. Budd and W. V. Mitchell.
Steering mechanism for motor vehicles (27,803)—J. A. Chisholm.
Motor vehicles (27,549)—S. Coulier.
Safety guard for motor vehicles (27,601)—A. Davies.
Motor vehicles (27,887)—W. W. Douglas and C. Ray.
Self-locking lifting jack (27,499)—A. A. Faehrmann.
Change speed gearing (27,783)—A. L. R. Rathbone.
Trolley heads for electric vehicles (27,692)—Shanghai Electric Construction Company (*D. McColl*).
Motor vehicles (27,871)—P. G. Tacchi.
Direction indicator for vehicles (27,402)—H. H. Williams.
Means for automatically steering trailers (28,641)—J. D. Boon and Eagle Engineering Company.
Trolley heads for electric trams (28,406)—G. L. Butler and M. J. Railing.
Wheels for motor vehicles (28,312)—C. T. Drigenko.
Driving gear wheels of tramcars (28,422)—J. Farley and T. R. Irving.
Differential mechanism for motor vehicles (28,301)—J. D. Johnson.
Direction indicator for motor vehicles (28,423)—J. R. Kay.
Electrically illuminated traffic signalling devices (28,357)—A. J. Marks.
Automatic safeguard signal for motor vehicles (28,287)—E. Normansell and T. H. Normansell.
Petrol filter for motor vehicles (28,130)—Rudge Bros., H. T. Rudge and W. H. Rudge.
Electrical contact makers for steering wheels of motor vehicles (28,681)—J. L. Scott.
Direction indicators for motor cars, etc. (28,651)—H. N. Stork.
Variable speed gears for motor vehicles (28,471)—C. A. West.
Motor vehicles (28,600)—B. B. Willcox.
Motor vehicles (28,878)—R. Boehm.
Tipping mechanism for motor vehicles (28,961)—A. Craig.
Warning devices for motor vehicles (29,028)—A. R. Roach-Cuming.
Light railways (29,186)—F. H. Dutton and R. S. Stronach.
Direction indicator (28,836)—J. W. Elliott.
Apparatus for indicating speed of vehicles and giving warning when predetermined speed is obtained (29,082)—C. F. Kubec.
Lifting jacks (29,109)—Lake and Elliott and A. D. Powell.
Front life-guard for motor vehicles (29,296)—J. H. Lloyd and W. H. Lloyd.
Motor omnibuses (29,271)—R. S. Pilcher.
Accumulator-driven vehicles (28,947)—K. J. Thomson.
Steering wheels for motor vehicles (29,016)—W. L. Tobias.
Motor vehicles (28,963)—H. Gough-Turner.

SPECIFICATIONS PUBLISHED.

1919.

Tires (8,339—*150,373*)—Dunlop Rubber Company and C. Macbeth.
Fluid pressure braking apparatus (13,583—*150,408*)—Westinghouse Brake Company (*Westinghouse Air Brake Company*).
Brake operating mechanism for motor vehicles (13,849—*150,423*)—Bentley Motors, Limited, and W. O. Bentley.
Motor vehicles (14,470—*150,448*)—H. Crochat.
Shock absorbing devices for motor vehicles (15,329—*150,461*)—B. H. Bayliss.
Brake Shoe hangers and brackets (15,612—*150,463*)—W. T. Sewell.
Live axles or countershafts for motor vehicles (17,049—*150,491*)—J. F. Buckingham.
Electro-magnetic braking apparatus for electric tramway cars (22,247—*132,788*)—G. L. Mayfarth.
Petrol tanks for motor vehicles (25,148—*150,554*)—Humber, Limited, and J. A. Cole.
Lifting jacks (14,123—*150,788*)—A. Shrieves and H. E. Shrieves.
Steering gear of mechanically-propelled vehicles (14,156—*150,789*)—C. S. G. Edmonds and A. B. Hart.
Driving mechanism for motor vehicles (17,135—*150,868*)—J. S. Withers (*Perfecto Gear Differential Company*).
Means for securing tramway rails to sleepers (19,526—*150,886*)—C. T. Walker.
Automatic steps for tramway vehicles (32,856—*150,933*)—F. Neri.
Motor omnibuses (14,746—*151,060*)—W. J. Hickman.
Direction of travel indicators for use on road vehicles (25,370—*151,171*)—H. Oxley.

1920.

Bearings for the driving axles of power-driven vehicles (963—*137,825*)—Arop-Ges. Ladish, Siedel and Company.
Lubricating the wheel flanges of vehicles running on rails (15,426 *145,009*)—P. Jager.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1919. WEEKS ENDED					1920. WEEKS ENDED.					AGGREGATE.		
	Oct. 4	Oct. 11	Oct. 18	Oct. 25	Nov. 1	Oct. 2	Oct. 9	Oct. 16	Oct. 23	Oct. 30	Wks.	1920.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdeen Corporation	3,219	3,264	2,997	3,030	2,899	3,929	3,876	3,738	3,576	3,606	24½	88.047	+ 14,212
Ayr Corporation	551	497	482	501	463	804	604	595	551	550	24	22.364	+ 1,762
Barrow Corporation	737	732	654	699	...	968	963	972	872	...	29	26.650	+ 3.053
Belfast City Tramways	...	...	10.274	10,605	10,293	...	...	11,638	11,487	11,408	31	356,329	+ 35.590
Birkenhead Corporation	3.725	3,089	3,014	2.962	2 850	3.304	3.375	3.295	3,081	3.093	30½	104.418	+ 13.877
Birmingham Corporation	27.659	26.468	25.486	26.488	26.112	34.747	34.963	34.639	33.393	33.308	31	941.618	+ 143.161
Birmingham Motor 'Buses	1.938	1,777	1 597	1.682	1.615	2.094	2.045	2.056	1.935	1.915	31	62.889	+ 8.528
Blackburn Corporation	2.620	2.408	2.016	2.197	2 009	3.160	2.615	2.953	2.555	2.146	30½	83.189	+ 9.390
Bradford Corporation	13.177	11.544	11.964	11.166	11.248	13.313	14.777	16.075	14.116	14,741	31	394.716	+ 36.881
Burnley Corporation	3.384	3.202	2.896	3.033	2.899	3.583	3.965	3.720	3.409	2.630	—	—	—
Burton-on-Trent Corporation ...	505	520	491	499	497	649	715	647	614	539	31	18.476	+ 2.812
Bury Corporation	3.058	2.281	2.192	2.212	2.099	2.798	2.779	2.600	2.045	1.826	30½	81.179	- 5.743
Chatham and District	1,482	1.506	1.455	1,451	1.354	1.907	1,963	1.900	1.769	1.658	43	75.269	+ 9.159
Cork Electric	860	878	766	821	721	761	729	788	757	763	43	35.020	+ 4.554
Derby Corporation	1.893	1.966	1.900	1.929	1,886	2.327	2.370	2.356	2.250	2.156	31	69.858	+ 9.403
Dundee City	2.663	2.755	2.430	2.452	2.466	3.297	3.276	3.214	3.180	3.188	23½	70.756	+ 9.530
East Ham Corporation	2,453	2.281	1.833	1.846	1 831	2.296	2.233	2.237	2.099	2.104	30½	61.262	+ 1.768
Edinburgh Corporation	11,312	10.819	10.186	10.370	9,823	13.231	12.850	12.243	11.708	11.878	24	300.742	+ 20.374
Edinburgh Motor 'Buses	...	...	...	...	...	1.121	970	963	1.031	1.053	24	21.487	—
Glasgow Corporation	36.605	33.521	32.886	33.281	32.708	48.615	48.799	47.602	47.073	45.824	21	963.113	+ 257.198
Glossop (Urban Elec. Supply Co.)...	257	228	208	221	216	266	289	276	264	259	44	10.365	+ 497
Huddersfield Corporation	5.311	4.816	4.688	4.801	4.715	5.752	5.502	5.383	5.218	5,218	31	157,455	+ 4.022
Ilford U.D. Council	1,309	1.179	1.083	1,145	1,132	1 450	1.387	1.352	1.254	1.282	30½	39.970	+ 2.765
Ipswich Corporation	850	880	847	872	853	976	1.039	967	888	881	30	31.542	- 1,961
Isle of Thanet...	1.066	790	638	687	544	1,392	897	931	740	521	39	3.090	+ 284
Kilmarnock Corporation	295	279	277	278	273	392	383	358	348	350	24	8,875	+ 1.823
Lanarkshire	5.317	4.488	3.860	4,127	3.902	4.838	4.597	4,577	4.372	4,272	43	183,745	+ 23.210
Leicester Corporation	5.832	6.326	5.926	6.024	5,824	7.009	7.121	7,033	6.631	6,178	—	—	—
Leyton U.D. Council	3.915	3.675	2.859	...	...	3.392	3.479	3 522	...	...	29	90.452	- 2.460
Liverpool Corporation	27.384	24.824	23.979	24,473	23.681	28.723	28.424	28.926	25.754	24,770	43½	1,190.560	+ 220.866
London County Council	91.314	91 312	75.792	76,123	76.059	94.160	100.668	101,984	98.710	97,697	30	2,622.782	+ 182.493
Maidstone Corporation	475	401	357	382	351	636	563	508	487	454	30½	15.509	+ 3.191
Manchester Corporation	32.796	30.733	29.601	30.383	29.753	37.550	39.244	39.716	38.349	37,008	31	1,010.734	+ 72.346
Newcastle-on-Tyne Corporation ...	10.556	9.358	9,161	10.482	8.982	11,186	11.550	11,203	11.098	11,104	—	333.839	+ 40.406
Nottingham Corporation	7.748	7.937	7.003	7.271	7.083	7.913	8.690	8.779	7.558	7 378	30	237.523	+ 5.4171
Oldham Corporation	4.956	4.556	4.390	4.363	4.169	4.973	5.066	4.892	4,758	4,686	32	150.283	+ 7.199
Reading Corporation	1.567	1,515	1,467	1,487	1,489	1.787	1.693	1.725	1.658	1.552	30	51.556	+ 2.472
Reading Motor 'Buses	...	...	...	...	...	291	284	286	246	238	30	8.175	—
Rotherham Corporation	2,344	2.336	2.076	2.086	2.062	2.743	2.813	2.774	2.488	2.534	30	80.865	+ 16.983
St. Helens Corporation	...	2.013	1.570	1.633	1.577	2.361	2.214	2.374	2.138	1,978	30	64.361	—
Sheffield Corporation...	15.799	16.376	16.288	16.414	15.835	21.336	21.630	21.078	20.813	19.904	31½	661.336	+ 145.753
Southampton Corporation	2,546	2.518	2.375	2,465	2.349	3.469	3.424	3.391	3.200	3.289	24	96.048	+ 12.489
Southampton Motor 'Buses	90	108	136	189	162	248	234	246	222	235	24	6.869	+ 5.269
Southend Corporation	1,987	1.675	1.437	1.550	1.397	2.353	2.061	2.022	1.959	1.823	30	81.309	+ 8.365
South Shields Corporation	1,484	1.409	1.392	1.388	1.410	1.978	2.030	1.918	1.903	1.806	31	60.181	+ 16.189
Sunderland Corporation	2.743	2.682	2.659	2.689	2.643	3.081	3.033	2.984	2.905	2.801	31	95.929	+ 5.454
Swindon Corporation	351	342	331	351	330	413	381	398	384	351	30	11.936	+ 554
Tyneside Tramways and Tramroads	2,000	1,791	1,019	1,684	...	1.338	1.269	1.316	1.200	...	16	21.591	- 392
Wallasey Corporation	2,485	2,399	2.246	2,337	2.191	2.658	2.500	2.514	2.311	2.323	30½	81.561	+ 421
Walsall Corporation	...	...	1.593	1,615	1.549	...	...	1,780	1.682	1.705	31	54.028	+ 8,520
Walsall Motor 'Buses ...	...	...	551	616	737	...	...	1.183	1.039	969	31	34.033	+ 17.221
Walthamstow U.D. Council ...	1,841	1,652	1,490	1,501	1,542	2,124	2,092	1,988	1,853	1,912	30½	64.721	+ 10.589
Warrington Corporation	959	...	...	...	...	1.020	...	...	...	...	—	—	—
West Ham Corporation	6,753	*6.428	4,957	5,065	5.036	6.177	6,325	6,350	6,046	5,903	30½	168.666	+ 1,907
Wolverhampton Corporation ...	2,044	2.079	1,863	1,989	1,860	2,640	2,468	2,720	2,336	2,338	30	74.222	+ 13.363

*Results affected by Railway Strike.

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.	1919. WEEKS ENDED.					1920. WEEKS ENDED					AGGREGATE.		
	Oct. 4	Oct. 11	Oct. 18	Oct. 25	Nov. 1	Oct. 2	Oct. 9	Oct. 16	Oct. 23	Oct. 30	Wks.	1 20.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine	60.956	70,321	69.079	66,846	65.630	78,304	79,844	80.335	81.224	80.064	43	3,269,850	+ 775.589
Calcutta ... ... Rs.	94.845	79.567	79.342	81,967	82,146	69.196	71,193	95,541	96,261	70.804	43½	3.897.630	+ 273.105
Madras... ... ... Rs.	44.557	(2 weeks)	47,890	(2 weeks)	46,552	50.708	(2 weeks)	51.484	(2 weeks)	49.003	43	997.136	+ 158.682
Pernambuco	5,870	6,084	6,119	6,059	6,181	5,314	5,557	5,550	5,600	5,608	43½	291,662	+ 61,953

Companies issuing Monthly Statements only.

	1919.						1920.						Wks.	AGGREGATE.	
	May	June	July	Aug.	Sept.	Oct.	May	June	July	Aug.	Sept.	Oct.		1919-20.	+ or -.
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	3,266	3,261	2,982	2,192	3,396	...	3,672	3,671	3,689	3,588	4,191	...	24	23,744	+ 4,354
Brazilian Trac. Mlrs	9562,000	9369,000	10,070.000	9734.000	9792,000	...	10985000	10874000	11745000	11837000	12043000	...	39	96,665.000	+ 13106.000
Brisbane	...	...	41.610	42,245	41,980	43,530	...	...	53.300	46,650	45.440	46,300	43	459,330	+ 69.420
British Columbia $	628.847	411,605	642,090	567.170	584,946	...	720.004	710,210	740.200	756,543	756,950	...	13	2,253.693	+ 259.487
Buenos Ayres L'c'z.	47.319	61,356	45,222	46,846	45,310	49,692	54.563	50.635	51,508	53,952	53,603	57,619	17	216,682	+ 29,612
Burma	38.900	41.516	44,050	43,683	43.152	...	46,785	50,471	52,289	48,552	50.980	...	8	99,532	+ 12,697
Cape Town ...	23,405	...	12,792	...	19,759	...	24,395	...	23,711	...	23,699	...	—	—	—
Carthagena & H. ...	3,226	3,373	4,183	2,991	1,539	1,465	5,313	5,562	4,164	3,721	2,273	3,319	43	42,083	+ 15,114
Cordoba	...	17,188	18.308	17,627	17.833	...	...	20,056	20,197	21.032	19,612	...	26	120,439	+ 15,376
East India ...	2,131	2,323	2,687	2,761	2,831	2,855	3,980	3,862	4,081	4,109	4,228	4,299	13	180.081	+ 40.281
Kalgoorlie	2.796	2,646	2.815	...	...	...	3,276	3,029	3,194	...	...	...	30	21.137	+ 2,480
La Plata	...	...	5,317	5,729	5,541	6,194	...	...	5,353	5,715	5,656	6,310	43	56.178	- 1,059
Lima	42.974	47,855	49.022	49,021	...	...	54,969	55,919	59,685	58,851	...	...	35	461.800	+ 80.711
Manila ... $	202.449	160.714	189,653	194,018	...	...	280.145	267,169	282.260	292.760	...	...	35	2.215.014	+ 604.837
Monte Video ...	37.382	34,750	34.039	34,873	...	...	42,401	39,989	39,647	42,771	...	...	43	429,706	+ 60,757
Para	24,503	24,647	24,659	24,890	24.386	...	25,842	25,403	24,254	24,582	23,185	...	43	245,941	- 71
Peruvian ... $	1059,150	...	...	...	982,850	...	1287,070	...	...	...	1187.300	...	13	3,511.445	+ 303.681
Port Elizabeth ...	5.145	...	3.247	...	4.372	...	6,165	...	...	6.106	5.803	...	—	—	—
Rangoon	6,533	6,276	6,562	6,472	6,812	...	7,933	7,849	7,911	7,856	7,657	...	39	70,895	+ 12,423
Toronto ... $	1032,717	842,697	977,262	1083.741	1124,159	...	1206,930	1127,239	1189,315	1225,682	1,270651	...	39	10731396	+ 1.412.938
Winnipeg ... $	248,191	112,615	337,978	353,194	381,248	...	404,742	407,625	391,709	368,616	426,647	...	39	3,831,649	+ 884 589

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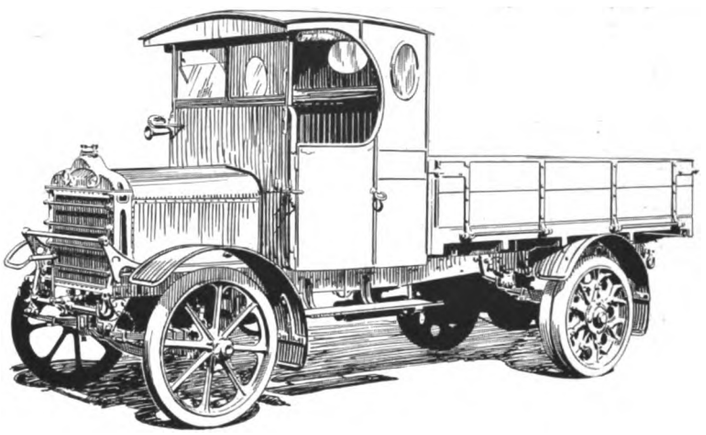

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THE COMMERCIAL VEHICLE EXHIBITION.

As a means of stimulating trade the recent Commercial Vehicle Exhibition at Olympia, of which a description is given in the following pages, was more successful than was generally anticipated. For some months prior to the exhibition there had been a general tendency towards depression in all sections of the trading community. This, it was felt, must necessarily react seriously on the demand for commercial motor vehicles. Moreover, the Government's policy as regards finance, and also as regards the safeguarding of industry against unfair competition, has been by no means encouraging. The very abnormal state of the rates of exchange has enabled certain European manufacturers to place upon our markets commercial vehicles, mainly war worn and reconditioned, at prices by no means representing the real market value of the vehicles in their home market. Again, there has been the competition of our own reconditioned military machines. The result of this combination of circumstances was that many manufacturers candidly admitted that they did not expect the show to be of the slightest value to them. It now appears that they were pleasantly surprised. A certain amount of trade was done upon the spot, and in addition there was a large volume of real solid inquiries from which business must materialise before long. Depression in other trades has affected these inquiries, inasmuch as a fair proportion of them cannot develop into orders at the moment, though the business is a certainty for the future. Thus it remains for the commercial motor industry to carry on through a somewhat difficult period, and to use its best endeavours to develop new markets overseas.

SUCCESS OF THE IMPERIAL MOTOR TRANSPORT CONFERENCE.

The oversea inquiries at the show were quite satisfactory. In a large measure this was probably due to the fact that the representatives of a large number of important oversea interests were brought together at Olympia to attend the Imperial Motor Transport Conference. This conference proved to be an interesting and instructive gathering. It was generally agreed that the discussions on various transport questions were extremely useful to practical men. In fact, at the conclusion of the gathering a resolution put forward by oversea delegates was unanimously carried expressing the strong hope that further conferences would be organised in due course in view of the benefits which have been derived on the present occasion. It was, by the way, satisfactory to hear on the whole very favourable reports of the behaviour of British vehicles overseas as compared with foreign competitors. There were still some criticisms as to the rather casual behaviour of some British manufacturers in dealing with oversea inquiries; but the general tone denoted a better mutual understanding than existed prior to the war.

THE FUEL QUESTION.

Five sessions of the conference were devoted to various aspects of the fuel question, the gravity of which is certainly sufficient to justify all the attention that can be given to it. The various papers that were read and supplemented by discussion may, when taken as a whole, be regarded as a fairly complete survey of all the possibilities in sight. As such they were not altogether discouraging. Great interest was taken in the possibility of utilising waste vegetable matter as fuel. It is clear that much can be done in the way of getting liquid fuels from coal, provided only that, as a nation, we can be persuaded to abandon our extremely wasteful methods of consuming our chief native fuel. The question of power alcohol was thoroughly thrashed out. That there is at least some grounds for optimism in this direction was indicated by the fact that several delegates representing official oversea interests expressed the hope that the Governments they represented would be invited to contribute towards the work being done by the Empire Motor Fuels Committee, and promised their own support to any such application. A point which ought to have been sufficiently clear long ago, but has led to frequent misconceptions, is that there is practically no hope of producing alcohol fuel at a competitive price from crops grown in Great Britain. This was amply demonstrated during the discussions, and plenty of stress was laid on the undoubted difficulties which stand in the way of power alcohol production overseas. These difficulties are of many kinds. They include questions of labour, of the marketing of crops that must be grown in rotation with alcohol crops, of finding suitable locations for distilleries, of transporting crops to the distillery and the fuel to the markets, and of regulations devised to secure a revenue out of potable alcohol and to prevent the improper consumption of fuel alcohol.

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MOTOR TRAFFIC

As to the last point, it is clear that regulations can be much simplified and cheapened without serious risks. As to all the others, consideration shows that the difficulties can be overcome by production of alcohol crops in very large quantities, by the provision of proper transport facilities, and, in both connections, by the friendly collaboration of the Governments of the Empire. At the concluding meeting of the Fuel Section of the conference a resolution was passed recommending the Imperial Motor Transport Council to invite oversea Governments and organisations to subscribe to the cost of the active programme of the Empire Motor Fuels Committee. This committee is already financially supported by the Royal Automobile Club and the Commercial Motor Users' Association, so it is to be hoped that, from now onwards, progress will not be held back through lack of adequate funds.

ROADS AND TRANSPORT OVERSEAS.

The second section of the conference dealt with roads and transport. There was a very interesting discussion on road development throughout the Empire, in the course of which much valuable information was given as to the position overseas by representatives of Canada, India, the Malay States, Australia, New Zealand, Tasmania, South Africa, Ceylon, and Jamaica. The meeting recognised that there is a tremendous amount of missionary work to be done if the public everywhere is to be properly educated up to a full realisation of the importance and national value of good roads. It was felt that excellent work in this direction could be done by voluntary organisations operating on the same lines as our own Roads Improvement Association, and a resolution was unanimously passed recommending that, where not already in existence, such associations should be established in all parts of the Empire, and should be linked up together by some system of affiliation to a central body. Assuming that the Roads and Transport Committee of the Imperial Motor Transport Council would act as this central body, the carrying out of this resolution obviously means a very big piece of work for that committee, involving a paid staff and therefore a sufficiency of funds. It was also generally agreed that road development, being vital to mechanical transport, should receive the fullest possible support, encouragement, and supervision from all governing authorities, and should be treated as a national and not as a local matter. Another resolution pointed out how essential it is that all main and connecting roads should be constructed to bear mechanical transport. A third advised the interchange of information between all parts of the Empire, while a fourth drew attention to the principle that the proceeds of taxation of self-propelled vehicles should be devoted wholly to the roads.

VEHICLES FOR SERVICE OVERSEAS.

On the last day there was a very interesting discussion on the provision in all parts of the Empire of motor vehicles suitable for military purposes. Collaboration by the Empire Governments in this matter was recommended, with a view to securing the utmost uniformity possible. Finally a resolution, moved and seconded by oversea representatives, was carried unanimously expressing appreciation of the utility of the conference, the hope that similar gatherings would be organised in the future, and the desire that the organising council should collect information from all parts of the Empire as to the nature of requirements in respect of motor traffic. This information would be submitted in suitable form to manufacturers, with a view to encouraging the production of vehicles thoroughly well suited for the generality of purposes overseas.

MINISTRY OF TRANSPORT POLICY.

There is some danger of the Ministry of Transport producing an immense number of regulations and restrictions calculated to eliminate any grievances that any section of the public may have against any form of road transport, but inevitably having the effect of discouraging and restricting the use of motor vehicles. It is to be feared that the present tendency is all in the direction of the present line of policy. The Ministry is at present busy in considering the details of the application of its new scheme of motor taxation. This scheme is in itself repugnant to most motor users, who would much have preferred the continuation of the petrol duty. By the time it is bolstered up by scores of bye-laws and the like, necessitating observance of an immense number of formalities and throwing dozens of new responsibilities on to motor manufacturers, traders, and users, it will be more repugnant still. The idea of insisting that the licence card which will have to be carried on every motor vehicle must necessarily be placed on the outside of the body is merely irritating, because such a card amounts to a disfigurement on a high-class private car, and its exposed position rather encourages wilful or accidental damage or defacement. The scheme of registration books is in a sense still more annoying, because it is less essential. Its only purpose appears to be to help the police to trace stolen vehicles. But the somewhat trivial object of this system can apparently not be attained unless we are to couple up with it a still more aggravating scheme for the issuing of police licences in respect of all vehicles exported. This will certainly discourage the free use of cars, and be a serious annoyance to the trade. Next we have the rather pig-headed refusal of the Ministry to consider the suggestion that licences should be taken out on any date and remain in force for a given period from that date. The proposed regulation that all licences should only date from the beginning of some quarter of the year will act as a deterrent of business in motor vehicles during the few weeks before each quarter day. People will not want to pay three months' licence duty for a couple of weeks' use of a car. From the point of view of the motor industry an even more serious matter is the proposal to exact a high annual payment in respect of the use of each red number plate supplied to enable the manufacturer or trader to test his vehicles upon the road, to deliver them to his depots, and so on. If the cost of conducting this work is to be increased by taxation we may be fairly certain that in practice the increased cost will be passed on to the motor user when he purchases the vehicle, so that in effect he will be paying a double tax during the first year of its use.

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MOTOR TRAFFIC

COMMERCIAL MOTOR EXHIBITION.

INAUGURAL CEREMONY.

MINISTER OF TRANSPORT ON THE INDUSTRY'S REQUIREMENTS.

Sir Eric Geddes, Minister of Transport, visited Olympia on October 15 to open the Commercial Motor Exhibition. He was received by Mr. A. S. Mays-Smith (president of the Society of Motor Manufacturers and Traders), Mr. S. D. Begbie (vice-president), Colonel J. A. Cole (vice-president), Mr. Hamilton Hobson (hon. treasurer), Mr. E. Manville, M.P. (past president), and Mr. F. Churchill (chairman of the Exhibition Committee).

The MINISTER OF TRANSPORT, invited to perform the inaugural ceremony, said—It is a very great honour to open the first exhibition of commercial motors after the war. Your last exhibition was in 1913, and since then the number of exhibits and stands and, of course, the output and use of commercial motors has increased enormously. Your industry was in almost an experimental stage before the war, and although you did not hold exhibitions during the war, you were engaged on very great and very grim reliability trials. I do not know whether, had you had the stimulus of these exhibitions, your industry would have developed to a greater extent than it did as a result of these reliability trials of war. Now we have an industry which may have been dreamed of by those who were engaged in it twenty years ago, but certainly not by the general public. For its development you required three things. First, good roads. Whether there has been agreement or not, there is no difference of opinion between us on the fact that a certain sum from a central fund had to be found for the roads. The users and manufacturers, though they differed as to the methods of raising the money, were unanimous that it had to be raised, and unanimous that in the conditions that existed it should be raised from the users of the roads. That gives a sum which it is estimated will next year be eight million pounds. With that income and what the local authorities spend on roads, amounting to three or four times as much, we can see our way to what I venture to think is one of the greatest advancements in the matter of roads in this country since the times of the Romans. The second thing is non-interfering, but prudent regulation. In that, with the co-operation of every representative of the industry, the Ministry of Transport are endeavouring to provide legislation and regulations which will not be restrictive. I look with suspicion upon the agitation against great road commercial vehicles. We hear complaints against the chars-a-bancs traffic. I have made it my business to travel through the country and watch that traffic myself, and I have seen more discourtesy and disregard for the people on the road from the private owner than from the great commercial vehicles. At the same time, roads are not constructed in the ideal way for these great vehicles, and the drivers should continue to regard the convenience of other road users to the greatest possible extent, or otherwise the agitation will have a foundation. The third point is prudent and wise development. I hope that either through this society or some other society interested, development will proceed on the lines which are more advanced in the States of clearing houses, of arrangements so that cut-throat competition does not bring bankruptcy to the young concern, and of educating the people who are using the wonderful vehicles we see around us to-day. It seems to me that those three things, with the ingenuity of the manufacturers, will carry this great industry forward, and will make it what it is fast becoming, one of the very important means of communication and transportation for the benefit of the civilisation of the world. I had hoped I should have been able to talk at more length on this subject at the luncheon to-day. The industry and the use of mechanical traction on the roads is a subject with which I have the greatest sympathy. Unfortunately my intention of having the pleasure of speaking at your luncheon has been interrupted by the threatened coal strike. I wish to take this opportunity of telling you how sympathetic I am with your industry, and have great honour in declaring this exhibition opened.

Mr. MAYS-SMITH, president of the society.—I am sure we shall all be pleased to express our hearty thanks to the Minister of Transport, Sir Eric Geddes, for having, at great inconvenience, come here this morning to declare this exhibition open, and to wish it every success. In my own name, and in the name of the Society of Motor Manufacturers, I offer him our most hearty thanks for his kind support.

Sir Eric Geddes then made a tour of the building. He made a close inspection of the charaphone (an instrument conveying warning of oncoming vehicles to the driver) and the giant pneumatic tires.

At the luncheon the loyal toast and that of the exhibitors were duly honoured.

PROBLEMS TO BE FACED.

Replying on behalf of the motor industry, Mr. F. CHURCHILL, chairman of the Exhibition Committee, said—I am sorry that Sir Eric Geddes is unable to be with us now, because I feel that my remarks must in the nature of things be largely addressed to the Ministry of Transport. For I think that at this juncture the future prosperity of the industry rests very largely indeed in the hands of the Ministry of Transport, for they are at present formulating legislative proposals, and I am also sorry to say proposals or details in connection with the new motor taxation. This industry has never had any definite statement or explanation given to it as to why self-propelled vehicles only should be taxed. Sir Eric Geddes in his speech said it was agreed on all hands that certain funds should be raised by users of the roads, and with that I am sure the industry agreed, but I do not think they ever expected that that would be limited to the motor vehicle users. I notice in a statement made by Sir Eric a few days ago that there are 278,000 horse-drawn vehicles employed in this country in the transport of goods, while large numbers more are used for the conveyance of passengers, and I express the hope that sooner or later these other horse-vehicle users will receive the attention of the Chancellor of the Exchequer and the Minister of Transport. The legislation for which the industry is looking, I think, is mainly that which will enable the manufacturers to produce, and the user to employ motor vehicles of greater economic and commercial value than those at present employed. Because I think it is agreed on all hands that the vehicles at the present moment are limited in their economic value by restrictions of both speed and weight. Sir Eric referred to the severe reliability trials which took place on the other side of the water. I think that if British manufacturers had had to design their vehicles after the war had started, they would have been in a very bad way. If there was one thing which the use of these vehicles in the war proved, it was that there was no need for a subsidy type of vehicle. The British manufacturers had already produced a vehicle which was fit for all purposes. One good thing, however, can be said for the war—I think it did more to advertise the capabilities of the modern motor vehicle than probably ten years of the most ardent salesmanship. If any further proof were needed of the capacity of the modern motor vehicle, it was afforded during the railway strike of last year. I have put down a note of four things I consider essential to the future development of the industry, and I find that Sir Eric is in agreement with one or two. The first thing is the question of good roads. A great deal may be said in regard to this. I will not, however, deal with this in any detail. But I should like to say that the industry does appreciate the very thorough manner in which the Ministry of Transport is now tackling the road problem. I am sure that the trade has every confidence in that department presided over by Sir Henry Maybury, and we may be quite sure that when the work is done it will be thoroughly well done.

GREAT CONCESSION TO LOCAL AUTHORITIES.

It is very gratifying, I think, to this industry to know that the Ministry of Transport is so convinced of the economy to be effected by the use of motor vehicles that they have created a fund to assist local authorities who are responsible for road work to purchase these vehicles. In all cases where the purchase of motor vehicles for road work is approved by the Ministry they are prepared to contribute 33⅓ per cent. of the capital. This is a big concession, and it has a double effect, because it not only reduces the amount of capital to be found to purchase the vehicles, but it also reduces the cost of operation due to the small capital involved so far as the local authority is concerned, and in many cases this amounts to the equivalent of 2d. to 3d. per mile. As the cost of transport of road making materials is, under normal conditions, considerably less when done by motor vehicles than by horse teams, the additional economy effected by purchasing under this scheme of the Ministry makes it practically obligatory on all local authorities to employ

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MOTOR TRAFFIC

this method, because it is obviously their duty to those who find the money to use the most economical plant. Apart from the fact of whether a local authority can qualify for that grant in aid or not, I think that there is still the obligation for them to look into this question of the cost of transport, for to-day the methods usually employed represent a charge of 4s. per ton mile, while if the same is done by motor wagon it comes out at only 9d. per ton mile. One of the essentials which Sir Eric Geddes did not mention is the question of a cheap and plentiful supply of fuel. While the sources of supply remain as at present, I do not feel that I can add anything to the common expressions of complaint and dissatisfaction, but there is the question of alternative fuel. I hope that considerations of excise will not be allowed to outrule all others. I understand, first of all, that the chief stumbling block is the inability to meet the Government regulations in regard to a suitable denaturent for alcohol. I believe the conditions are almost impossible to fulfil. Sir Eric raised the question of the importance of the establishment of clearing houses for road-borne freights. This is receiving a good deal of attention, and perhaps one might say it might be best left to private enterprise, but I throw out the suggestion that the Labour Exchanges might be made a source of dissemination of information in regard to return loads.

Sir E. Geddes' Programme.

In a speech which the Minister of Transport made at the banquet of this society last year, he said, "I, as the first Minister of Transport, and my successors will feel that we have failed terribly if we do not remove from the path of the motor industry the legislative difficulties which have confronted the industry and transportation as a whole for thirty years." The whole industry and the public who use the products of that industry are now, I think, looking to the Ministry to fulfil some of that programme. Unfortunately at this moment grave fears are entertained not only in the industry itself, but I think in the minds of users of all classes of motor vehicles with details in connection with the collection of taxes. The identification of ownership and the regulations generally governing the use of vehicles will not only act in restraint of our trade, but also prove vexatious and troublesome. For instance, there is a proposal at the present time that licences should date only from quarter days. I suggest that licences most certainly ought to date from any date on which they are taken out, for the three months, or twelve months, as the case may be, otherwise the business of every motor trader will be restrained in the latter part of every quarter, because buyers will naturally refuse to pay taxation except in respect of the period for which they have the service of the vehicle. A few days ago the newspapers illustrated a series of road signals which were alleged to be the decision of the Ministry of Transport or a department of the Ministry; I suggest that whilst these appear at first sight to be for the benefit and safety of all concerned, that the industry does not look to the Ministry of Transport for legislation of that sort. Such matters should be left to the Safety First Council, or some other means of educating drivers or bringing about that degree of carefulness on the roads which is desired should be adopted. We do not want regulations which will land drivers continually in prosecutions because probably a constable did not happen to see a man hold out his arm, or his arm was held out in the wrong position. I may tell you that there are other proposals in regard to signalling which have been before departments of the Ministry, and if they are ever carried out we had better learn to drive with our left hand at once, and leave the right hand available for legal requirements.

An Obnoxious Proposal.

I understand that proposals are being made by the Ministry to charge a considerable sum for the use of trade identification plates. The unfettered use of these is essential to both manufacturers and distributors, and I shall be expressing the views of the industry mildly when I say that the trade views those proposals with astonishment and with rather more resentment than is usually felt by people who are asked to pay taxes. The Royal Commission on Motor Cars, in reporting on this subject, said in their opinion these plates should be regarded only as a means of identification. If ever there was a time when the industry needed encouragement and help to meet competition it does now. It seems that the proposal to charge for these plates rests on the fact that the traders will have to use the plates in the conduct of their business. Of course we shall. But why, I ask, should a trader who has ten or twenty vehicles on the road for his business have to pay taxes, while a contractor with one hundred horse teams, or a railway company with a thousand horse teams on the road every day, is not asked to contribute? I am sure the trade will assist in carrying out any reasonable regulations in regard to these plates, and I suggest that the Ministry should do anything they can to help the traders in that way. I would ask the Ministry to take a broad view, and by that I mean that the industry is creating a source of revenue to the road funds. All the vehicles turned out and used in this country mean revenue to the road funds, and I think if the Ministry see that and realise that, they will realise that it is in their own interests to facilitate all they can the laying of these golden eggs.

THE EXHIBITION.

Seven years have passed since the previous exhibition of industrial motor vehicles at Olympia. It was therefore to be expected that the excellent display of business vehicles and accessories which had been arranged by the Society of Motor Manufacturers and Traders at their fourth international show would receive keen attention. The exhibition was formally opened by Sir Eric Geddes, Minister of Transport, on October 15, and remained open until October 23. Although somewhat under a cloud in consequence of the coal strike and the then threat of trouble on the railways, it was well attended throughout, and a considerable volume of business was transacted. The detail arrangements of the show were in the hands of an exhibition committee of which Mr. Frank Churchill was chairman, and great credit is due to these gentlemen in conjunction with Mr. J. C. J. Phillips, the exhibition manager, for the smooth working and the completeness of the stands on the opening day. From the point of view of the novelty hunter some disappointment may have been felt after an examination of the various exhibits, but from a practical standpoint the general level of excellence maintained throughout the entire exhibition bore striking evidence of the fact that the industrial motor vehicle has now reached a standard of reliability and efficiency which should inspire the confidence of all interested in transport undertakings. Two impressions gained from a survey of the exhibits were (1) the progress made by motor chars-a-bancs and (2) the way in which manufacturers generally are demonstrating that it is worth while to buy a new vehicle rather than to yield to the temptation to buy an overhauled one that has been returned from Army use. Some natural resentment has been felt in the trade that, in addition to being called upon to absorb the returned vehicles from our own Army, this country has had to take the surplus from the United States Army of Occupation, which the Americans refused to allow to be taken back to their country. Moreover, following the fallen value of the lire, British manufacturers have had to meet the competition of the Italian surplus army vehicles. One in every three of the stands devoted to motor vehicles and bodies seemed to be devoted to chars-a-bancs—an eloquent indication of the extent to which these vehicles are becoming part of the public services of the country. A noticeable feature also was the number of omnibuses shown that were destined for use as auxiliaries to municipal tramway services. Municipal authorities—of which many representatives attended—found much to interest them; there were wagons of all capacities for every class of their transport requirements, tipping wagons for the economic and rapid handling of road material—a most important consideration in view of the reconstruction work which has to be faced during the next few years—street watering tanks, gulley emptying and flushing tanks, street cleansing and sweeping machines, refuse collecting vans, fire fighting appliances, tower wagons, omnibuses, coaches, etc. With regard to method of propulsion, choice could be made from steam, petrol, electric, or petrol-electric, excellent examples of each being on view. A wide variety of tipping wagons was shown, each known method of operation being demonstrated, some really clever devices, enabling the load to be tipped at will on either side or at the end of the vehicle being included.

The improvement in body work when compared with previous practice was marked—lighter in weight, greater capacity, and finer lines were the distinguishing characteristics of the types shown. In the tire and accessory section all the well-known solid tire manufacturers were represented, while several examples of the giant pneumatic tire, designed to take the place of solids on both goods and passenger vehicles, were in evidence both on the makers' stands and on vehicles. Amongst the accessories shown, electric lighting sets and electric starters, together with magnetos and sparking plugs, not only attracted attention on account of the number of these exhibits, but gave evidence of the high standard of efficiency to which manufacturers had attained in these essential details.

Of the more interesting and important exhibits brief notices are given, together with illustrations of various types of omnibuses.

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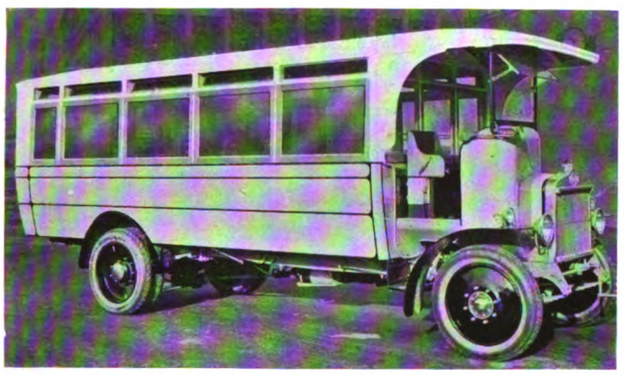
MOTOR TRAFFIC

Associated Equipment Company, Limited.—The stand of the "builders of London's omnibuses" was notable for passenger and industrial vehicles. The "K" type, 32-seat, single-deck saloon omnibus had Michelin pneumatic tires, the rear wheels twin. The complete vehicle was marked at £2,250, plus wages clause. Its specification in brief is 4-cylinder engine, bore and stroke 100 mm. v 140 mm., 30 h.p. at 1,050 revolutions per minute; speeds, three forward and reverse; final drive, worm, 8¼ to 1; track, 5 ft. 10 in.; wheelbase, 14 ft. 2¼ in.; chassis weight, 2 tons 6 cwt., complete omnibus 3 tons 6 cwt.; overall length, 23 ft. 5 in.; overall width, 7 ft. 2 in.; body space (back of driving seat to end of frame), 15 ft. 11¾ in. It is electrically lighted.

Another "K" type chassis was shown with a lorry body, with hinged and detachable sides, the complete lorry being £1,400, plus wages clause. Its nominal load capacity is 3 tons, and there is a permanent cab for the protection of the driver. The details of the chassis are very similar to those of the omnibus, but the overall length is 3 ft. less and the body space 1 ft. less. The tires are Dunlop solids.

A 4-ton "YG" type hydraulic tipping wagon has an engine of a new type manufactured by the company. It has four cylinders, bore and stroke 120 mm. × 150 mm., and is of 45 h.p. at 1,000 revolutions per minute. There are four speeds; final drive, worm, 8¼ to 1 reduction; track, 5 ft. 8 in.; wheelbase, 14 ft. 2⅜ in.; weight—chassis, 3 tons 9 cwt., 4 tons 2 cwt. complete; overall length, 19 ft. 6 in.; overall width, 7 ft. 1⅜ in.; body space (back of driving seat to end of frame), 11 ft. 4¼ in.; Dunlop solid tires. Price, with tires, £1,520, plus £65 for electric lighting (plus the usual wages and material increase clause). The body is of steel, with tailboard hinged at top, and the tipping gear can be operated by the driver unaided.



A.E.C. Omnibus Seating 30 Passengers.

A similar engine is fitted to a coach de luxe body upholstered in leather, seating 30 passengers, the nominal load capacity being 3 tons. It has a compartment with a table and seats all round, and electric light, while comfortable riding is ensured by Michelin pneumatic tires, twins being fitted at the rear. There are four speeds forward and reverse, and the final drive is by Lanchester worm, 6½ to 1 reductions; track, 5 ft. 8 in.; wheelbase, 14 ft. 2⅜ in.; overall length, 25 ft. over end of cape cart hood; overall width, 7 ft. 2⅜ in. The price, with tires, is £2,300, plus wages clause.

Albion Motor Car Company, Limited.—The exhibits from Scotstoun, Glasgow, were five models with a carrying capacity of from 25 cwt. to 4 tons. The well-known Albion 3½-ton hydraulic tipping wagons should appeal to all engaged in building construction and to public authorities, owing to the claim for economy put forward by the manufacturers. The Albion hydraulic gear, operated by means of a pump driven off the engine, enables a full load to be tipped in 75 seconds. Another model was the 32 h.p. 4-ton Albion lorry, on order for Messrs. West's Brewery. It is hardly necessary to make further comment on the 32 h.p. Albion; it made a high reputation for itself during the recent war, when nearly 6,000 were supplied to the British army. Since then many orders have been placed by various Governments in different parts of the world.

Of great interest was the new 20 h.p. model designed for lighter work and suitable for carrying loads up to 25 cwt., or as a chars-a-banc to seat 15 persons. It embodies the latest advances in motor engineering, and maintains in every way the high standard of design and workmanship associated with Albion manufactures. For special work where pneumatic tires are preferred they can be fitted to all wheels. There were two examples of the new model on the Albion stand—a chassis, where all the special features were at once apparent, and a 15-seat chars-a-banc. This size of vehicle is popular in many districts where road conditions do not permit of larger and heavier vehicles being used. The new chassis has been inspected by a number of experts, including engineers connected with various overseas Governments, and has been declared particularly suitable for countries where road conditions prohibit the use of heavier vehicles. It is interesting to note that the company have arranged, as a standard fitment to all their chassis, to include a mileage recorder of their own special design. The company also showed a box van to carry a load of 30 cwts. of the type that they have been producing in large quantities since the armistice.

A feature of the Albion stand which appealed both to users and drivers was the "Klersite" dynamo lighting set. The dynamo is driven off the engine and is so constructed that even when the engine is running slowly a bright steady light is assured. The lamps are fixed to the radiator column and are specially robust in view of their exclusive use on commercial vehicles. There is enough power to supply one 18-watt lamp or, alternatively, two 12-watt lamps. A focussing arrangement is provided for use when new bulbs are being fitted, and also an adjustment which permits the lamps to be moved up or down to suit the driver. This lighting set is supplied at an extra charge.

A noteworthy feature in connection with the 32 h.p. 4-ton chassis is the fact that it can be fitted with a low platform which appeals to many users whose loading sheds were previously constructed for horse-drawn vehicles.

Austin Motor Company, Limited.—The extraordinary development in transport of goods by road has called for the provision of motor lorries of almost a new type, exemplified in the new Austin 1½-ton lorry, which was a prominent exhibit from the Birmingham works, where it has for some time been produced on standardised lines. A unit of this capacity has a wide range of usefulness, for it carries a useful load without entailing the risk of running a heavy vehicle half empty. The growing requirements of a business can be closely followed up by gradually acquiring a number of such units. The new lorry is a four-cylinder machine of 22·4 h.p. R.A.C. rating. Its overall length is 16 ft. 11 in., width 6 ft. 1 in., while the loading platform is 9 ft. 7 in. long. It has a single plate clutch and a four-speed gear box with central control, while final transmission is by overhead worm. The engine has aluminium pistons and lubrication is by gear-wheel pump on the well-tried Austin system. The crank shaft is carried in five bearings; petrol is carried in a 15-gallon tank mounted on the dashboard. The chassis is of pressed steel plates. Another mechanical point is that the rear axles bear no weight, and front and rear road wheel hubs are carried on roller bearings. A characteristic Austin feature is the forward position of the steering box, and the carrying of the pillar outside the bonnet. The large amount of rake thus secured gives a setting to the steering wheel which reduces fatigue on the part of the driver to a minimum. Instead of a sector, a full worm wheel is used, and its position can be changed in order to take up wear. Semi-elliptic springs are fitted, 36 in. long at front and 48 in. long at rear. The foot brake operates direct on a drum mounted directly behind the gear box, and adjustment is very easy. The hand brake is of internal expanding type with drums bolted to the rear wheels. At the price of £725 the chassis is supplied with driver's cab with hood, glass windscreen, side curtains and doors. Electric lighting and starting are extra. The dashboard carries petrol gauge, oil-pressure gauge, switch and speedometer, and the equipment includes five lamps.

A similar chassis was utilised for the 25 h.p. coach, seating 20 persons in a body upholstered in leather and equipped with electric lighting. The tires were "Nobbycord" pneumatics. At £1,200 this vehicle has proved very attractive. Road surveyors and all interested in heavy haulage found the 25 h.p. Austin tractor an interesting exhibit, exceedingly cheap at £392 all on, while a trailer of 3 to 4-ton capacity, suitable for side tipping, was marked at £250.

Bristol Tramways and Carriage Company, Limited.—For very good reasons this stand was much sought after. The company, although they have been for many years specialists in the construction of passenger and freight-carrying vehicles for their own great business, have not hitherto manufactured for general sale. Moreover, their engineering and body designers have evolved from their long experience models for the market which have been thoroughly tested for omnibus, chars-a-banc, and haulage business.

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MOTOR TRAFFIC

In Bristol and district the feared weakness of railway bridges has caused the police authority to limit omnibus traffic to the single deck type, and many of these bodies have been running on the post-war Bristol chassis. The bodies accommodate 29 passengers. The company were pioneers in motor touring, their vehicles visiting all parts of the country. Thirty-five of their coaches have proved the merits of the new chassis, which is of 40 H.P. and takes a load of four tons.

In view of the interest attached to the Bristol chassis (the design of which is claimed as exclusive), a brief specification is appended—

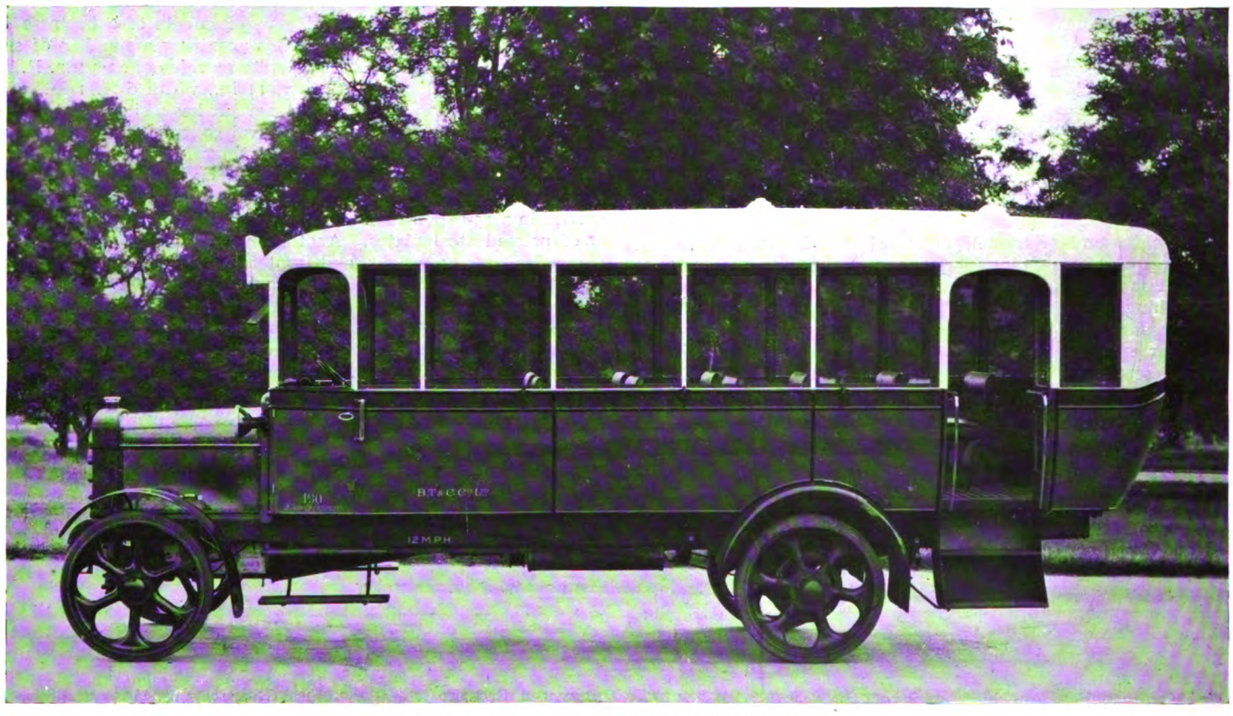
The engine is mounted by three-point suspension slung from a stamped steel bearer at front end as part of the engine unit. Four cylinders, $4\frac{1}{2}$ in. bore × $5\frac{3}{4}$ in. stroke, cast in pairs, developing 48 B.H.P.. at 1,400 revolutions per minute. All valves on near side. A governor mounted in camshaft chain wheels, limits engine speed to 1,400 revolutions per minute, and is claimed to be absolutely "fool-proof." Forced feed lubrication is employed, the oil being circulated by a pump driven off cam shaft by spiral gear. The system of cooling is by thermo-syphon, $3\frac{1}{2}$ in. pipes throughout. Four forward and one reverse speeds are provided. Special type of gate enclosed in box, only one selecter rod being used. Shafts are carried on ball bearings. The worm drive is constructed to take 6, 7 and 8·1 ratios. Standard ratio, 7·1. The whole of the driving mechanism is a self-contained unit, and is instantly removable without disturbing the road wheels. Ample brakes operating on pressed steel drums are provided. A gear drive is provided on the engine for the lighting dynamo, which is fitted high up under the bonnet.

Two examples of the chassis were shown, besides the engine with base removed, exposing details; parts of the Bristol clutch, showing the slight wear after service of 178,074 miles; and the gear box unit operated by an electric motor drive, to demonstrate method of changing gear. The interest attaching to the exhibits was attested by visitors making repeated inspections. The saloon omnibus body shown on chassis was a handsome product of the company's aeroplane factory. Weighing $22\frac{1}{2}$ cwt., the body derives great strength combined with lightness as the result of introducing methods and material adopted for air machines. Spring backs to the seats give comfortable riding. Upholstering is in light green, and the exterior has a blue coating, the wheel rims and spokes being red with brass cap. The chassis was also shown stripped.

JAS. BARTLE AND COMPANY, LIMITED.—A fine single-deck omnibus body on a CK 22 Daimler chassis, a torpedo chars-a-banc body on a Dennis chassis, and a 1-ton angle iron body with driver's cab for the conveyance of petrol in tins were conspicuous. The omnibus, of the Chester type, was built for the Crosville Motor Company It seats 23 persons, including the driver, arranged for two by the side of the driver and 20 on pairs of garden type seats. The seat cushions are of black leather hide made up on spring frames, the cushions being removable. Similar material

A Bartle Omnibus Body to Seat 23.

is used for the seat backs. To close the entrance at the rear there is a sliding door. On the exterior of the sides and at the rear is a projecting moulding to prevent damage from walls and vehicles. The char-a-bancs body was an excellent example of the high-class coach work for which Messrs. Bartle have become so deservedly known; this seats 30 on six rows of seats in green leather on spring frames. The lines were very pleasing, while the fittings and furnishing left little to be desired. An important feature in the equipment was the patent divisible hood, so arranged that each section folds down behind each row of seats. Each section consists of two bent hoops of steel, the longer one being mounted upon steel links of an ingenious design which hold it in an upright position when raised. As each section has a separate hood it can be manipulated by one man.



23-Cwt. Bristol Body Seating 29 Persons.

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MOTOR TRAFFIC

British Berna Motor Lorries, Limited.—New models were shown for loads of 2½-3 tons, 3½-4 tons, and 5 tons. The makers had the advantage of experience gained with 3½-4-ton machines supplied to the War Office. The first mentioned chassis was shown on a lorry body. It has a 4-cylinder engine, of 30-35 h.p., with internal gear drive. The 5-ton chassis has similar engine details, but is of 40 h.p. It was shown separately and also with a Berna power tipping wagon body, which can be operated sideways and endways in 10 and 15 seconds. Instead of internal gear drive, the 2½-3-ton machine has a bevel-driven live axle. It was attached to a lorry body, in which form the model has been supplied to the Birmingham and Midland Transport Company, for use with pneumatic tires. Much interest was created by the rubber-tired Berna road tractor, which has been in use in the Swiss army for mountain work. The British War Office had placed an order for 56, but the end of the war came soon enough to enable it to be cancelled. The tractor is similarly engined to the 5-ton chassis, but develops up to 45 h.p. and will draw a load of 30 tons on the flat, and 10 tons on a 12 per cent. gradient. Its price is £1,180; pulley and capstan are extra.

H. G. Burford and Company, Limited.—Two types of Burford machines were shown, as well as the Cleveland tractor for which Burford and Company are sole representatives in this country. The 2-ton chassis is fitted with a 30-h.p. Buda engine and a gear box giving four speeds and reverse. Two samples of the 2-ton model were staged, one being fitted with Michelin pneumatics and shown in its bare construction to enable visitors to inspect the design and workmanship, and the other fitted with a tipping body, the tipping gear of which is hand operated. The latter vehicle was constructed with a short wheel base to enable it to run on railway and other weigh bridges. The 1-ton machine shown was fitted with a 22-h.p. Buda engine and is similar in many respects to the heavier vehicle, except that it is lighter in construction and the gear box is arranged for three speeds and reverse.

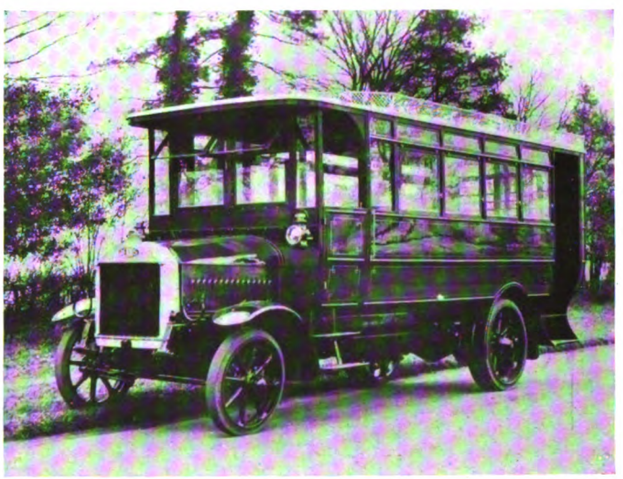
Caledon Motors, Limited.—This Glasgow firm showed their live-axle passenger chassis with 40-h.p. single sleeve-valve engine, on which was to be mounted a torpedo coach body upholstered in leather, and with cape cart hood. The body was exhibited on the stand of the makers, the Chelsea Motor Building Company. Seating 30 persons, the body was a distinctive piece of work. The same remark is applicable to the chassis, for the company's 4-ton passenger machine (fitted with Michelin pneumatic twin tires to the rear wheels) won the gold medal in the Spanish trials. A chain-driven 4-ton Caledon chassis, with 40-h.p Dorman engine, had a steel end tipping lorry body (shown outside the building). Tipping is achieved by Edwards' hydraulic, telescopic type gear. A 6-7-ton chassis attracted attention as having been introduced to meet the requests of customers at home and abroad. It is chain driven and has a 40-h.p. Dorman engine, with a four-speed gear box. Auxiliary coiled springs on the rear axle add to the notable springing of this chassis.

Clayton Wagons, Limited.—The 5-ton overtype steam wagon produced at the Titanic Works, Lincoln, is in great demand by public bodies. Recent orders include six for London County Council, two for Hendon Urban Council, four for Wexford County Council, two for Belfast Corporation, and ten for the North Riding Council. It is claimed that the Titanic Works are the largest in the country exclusively engaged on steam wagon manufacture. The company now make both over and undertypes, instead of the overtype only. The 5-ton exhibit had an engine of the 2-cylinder compound type, with double high-pressure connection, which allows both cylinders to be operated by high-pressure steam when great increase of power is required. Both cylinders are fitted with balanced piston valves; the boiler is of the locomotive type. The boiler feed pump is gear-driven from the crank shaft, and can be operated when the wagon is stationary. The mechanism of the end tipping body consists of an independent steam driven motor geared to two vertical screwed shafts. The wagon can be moved during tipping. Side tipping bodies are provided to order.

A second exhibit was a 6-ton undertype steam wagon with fixed body—this is an entirely new model which Messrs. Clayton are just placing upon the market—the boiler being of the patent vertical type, with 2-cylinder high pressure engine, all parts being enclosed and automatically lubricated. This latest Clayton carries a 6-ton load at the legal speed of eight miles per hour, when fitted with rubber tires, or five miles per hour on steel tires. It can also haul a trailer with 4 tons. Also shown were details of the fire box and valve gear of the undertype wagon, and samples of the firm's drop forgings.

Commercial Cars, Limited, Luton.—An entirely new production of this well known firm in the form of a 25-h.p. 2-ton chassis attracted considerable attention. The engine—4-cylinder, cast in pairs—is mounted by three point suspension direct to the frame, the valves being arranged on the left-hand side. Ball bearings are fitted to the crank shaft, and the cooling system is on the thermo-syphon principle. The change-speed gear is so arranged that the drive is taken up by a combination of sliding gears and dog clutch members. The final drive is by means of worm and worm wheels. A large tubular torque tube surrounds the propeller shaft, this being attached to a cross member by spherical torque joint. Other exhibits consisted of a handsome motor coach mounted upon the firm's "3 P." type chassis, a 30-cwt. 25-h.p. chassis fitted with a mail-van body, and 3½-ton 32-h.p. chain-driven chassis with a van body.

Dennis Brothers.—Two passenger vehicles were notable among the six exhibits, namely, a new model 32-seat single-deck omnibus and the Dennis 30-seat coach, the latter being to the order of the Lancashire United Tramways, Limited, who are already running 36 of this make. Both had a 40-h.p. engine to the 3–4 ton chassis, the engine being of four cylinders cast in pairs, with bore and stroke of 115 mm. and 150 mm., giving 1,000 revolutions per minute. Accessibility has been carried to perfection in all the Dennis chassis. It is seen in the arrangement of the magneto, oil pump, fan drive and the crank case, the lower half of the latter being removable without disturbing the working parts of the engine. In the back axle's steel casing the top cover is removable without



Dennis 32-Seat Omnibus on a 3-4 Ton Chassis.

taking down the axle or the wheels, and it carries with it the worm, the worm wheel, and the differential gear. The live axles themselves can be withdrawn without removing the wheels or jacking up the chassis. The portions of the radiator carrying the tubes can be dismounted. Engine control is by throttle and ignition levers on the steering column. The clutch is of an external cone type, Ferodo faced. The gear box gives four speeds and reverse. The back axle is contained in a steel casing, which carries the weight of the vehicle, the power being transmitted through special worm gearing, the final drive being by overhead worm. The frame is of pressed steel of channel section, with cross members of similar section. Engine, clutch and gear box are carried upon an underframe suspended at three points to ensure flexibility.

Similar features were to be seen in the 3-ton box van (sold to the Co-operative Wholesale Society), the new 30-h.p. 2½-ton chassis for service abroad, and the new 5–6 ton chassis fitted with mechanically-operated tipping wagon body, Wood's hydraulic gear being utilised. The latter chassis is specially strengthened, particularly the rear axle. The engine, with bore and stroke 115 by 150 mm., develops 40-h.p. at 1,000 revolutions. The Port of Spain, Trinidad, had ordered the 60-h.p. 400–500 gallon turbine fire engine, which fully upheld the Dennis reputation.

Dennis-Portland, Limited.—Three 30-h.p. machines came from the Dennis Guildford Works. Upon one was a 20-seat touring coach body, with complete shelter given to the driver. It was fitted with Dunlop giant pneumatics, single on each wheel. The

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frame of these chassis is built sufficiently narrow to enable the coach to be turned in 50 ft., and the lorries in 46 ft. For the former the wheel base is 13 ft. and 12 ft. for the lorry. The other exhibits were a chassis for a 2-ton load, and another with a standard lorry body, with cab, side doors, and hinged sides. The engine has four cylinders cast in pairs, gravity-fed Claudel-Hobson carburetter and Simms magneto. There are four speeds, the gear box being of aluminium. The final drive is by overhead worm, and the worm gear and differential are most accessible. The engine has three-point suspension. The Dennis-Portland is a new type of machine, but its merits are indicated by the fact that Dennis Brothers have undertaken its construction.

DAIMLER COMPANY, LIMITED.—The Daimler Company's exhibits consisted of four complete machines, two coaches and an omnibus on the C.K. chassis and a tipping lorry on the C.J. chassis. Each had the famous Daimler sleeve valve engine, bore 95 mm., stroke 140 mm. (Treasury rating 22·4 H.P.); trough lubrication, throttle controlled, magneto ignition, four forward speeds and one reverse, fabric-lined cone clutch, and steel wheels. The coaches and omnibus had a 13 ft. 6 in. wheel base and 5 ft. 3 in. track, and the tipping wagon 11 ft. 6 in. wheel base and 5 ft. 3 in. track.

The 25-seat coach represented the latest in design and equipment. Seating five abreast, it provides comfortable seating with plenty of leg space. The body was built to the company's specification by Messrs. Fairie and Charles, and consisted of a framing of best dry English ash, plate strengthened, with steel panels. The hood was made of stout waterproof twill, and when folded down has metal separators between the sticks to stop any rattling from the hood sticks. Giant single pneumatics were fitted to the coach, together with a mechanical air pump. A similar pump was shown as a separate exhibit.

The second coach seats 24 persons. It had a permanent roof, which affords the greatest comfort for passengers and absolute protection from bad weather. The celluloid windows, which are very light, slide into the roof when not in use. Its dimensions come well within any limits at present imposed for such vehicles, and it is anticipated that it will be well within the limits likely to be imposed. It is a foot narrower than the average sized body at present in use, and is a foot within the Local Government Board's limit of width. The passengers enter from the front; there is a central gangway, and ample room for movement. Provision is also made to carry all the usual impedimenta of the passengers. The lines of this coach are exceptionally graceful, and it is claimed to be a considerable advance in comfort and luxury on any vehicle of its kind. It had Goodyear giant pneumatic tires.

The third vehicle was a single-deck 29-seat omnibus, with two extra seats by the side of the driver. The body, built by Christopher Dodson, Limited, London, was the acme of lightness in appearance and of strength in construction. The framing was built of English ash and the floor framing of American oak. Impermeable millboard had been used for the panels with the exception of the front bulkhead and hind quarter panels, which are of aluminium. Polished plate-glass was used throughout for the windows, bedded dead into the framing and fixed with rubber and fillets. A special rubber catch holds the windows rigidly in position when three on each side are opened. There was a clerestory roof. The wheels had Goodyear giant pneumatic tires. The entrance is at the rear, and the seats are on the transverse plan.

Freight bodies were represented by an all-steel end-tipping lorry with horizontal tipping hoist. The capacity of this vehicle is 120 cubic feet, equivalent approximately to a load of two tons. The whole operation of tipping is under the control of the driver, who, by using a lever alongside the driving seat, can in the space of 15 seconds obtain a tipped angle of 45 degrees. This tipping hoist is an independent unit on a frame, and consists of a horizontal cylinder containing a piston operating through a piston rod to a crosshead at the rear of the cylinder. The crosshead runs on rollers on channel girders. The ends of the crosshead pull through links on to bell crank levers, pressing on rollers fixed to the bottom of the body, the body being hinged at the back of the chassis. A small gear wheel pump driven from the gear box, when required, pumps oil from the rear side of the piston into the front end of the cylinder pushing back the piston and rod, and thus raising the body. The lift can be stopped by the driver at any point by closing the valve to stop the flow of oil. Lowering is by moving the valve still further to allow the oil to flow from the front to the back of the piston, the speed of descent being limited by the viscosity of the oil. Disengaging the main clutch at any point will also stop and hold the body in any position, providing the clutch stop is used to prevent the pump acting as a motor. With a body of this type there is no lost space behind the cab, and the maximum ground clearance is obtained, features that will be appreciated where the load has to be tipped on soft ground or uneven road surfaces.

Daimler 29-Seat Omnibus with Dodson Body.

A noticeable feature on the tipping lorry was the driver's cab, designed and built as a separate unit, and one in which the comfort of the driver had been studied. It has full doors with plate-glass windows running in Beclawat channels, that work easily to permit of signalling. There are good-sized oval windows at the sides and back of the cab, with three ventilating louvres. This consideration for the driver's comfort in providing a fully enclosed cab will be appreciated during the winter months. In summer the doors can be wholly removed. The Daimler Company are standardising this type of cab, behind which any type of commercial body can be built other than a char-a-bancs.

DE DION BOUTON, LIMITED.—Three examples of a new 3½-ton chassis designed on experience gained in work with the French army were shown, together with the De Dion combined sweeping and watering motor appliance. The first mentioned were of 25 H.P.,

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given by 4-cylinder engines, cast in pairs, with a bore of 100 mm. and stroke of 140 mm. The drive is transmitted to internal gear rings on the rear wheels by two live axles, each fitted with two sliding universal joints and driven from the differential enclosed in a separate casing. On one lorry chassis solid tires were fitted, and on another lorry Michelin pneumatics. The third example was a van for one of the suburban stores of Selfridge. The sweeping and watering vehicle has a 4-cylinder engine developing 20 H.P. The tank has a capacity of 800 gallons, capable of distributing 50 gallons per minute over a width of 36 ft., the regulator for width of spray being operated from the driver's seat.

CHRISTOPHER DODSON, LIMITED.—General approval was bestowed on the single-deck omnibus body from the Cobbold Road Works, Willesden. The chassis was the Tilling-Stevens petrol-electric. Strongly constructed, it is of light weight and extremely well lighted, a C.A.V. plant providing illumination at night. The normal seating is for 28, but by means of tip-up seats in the gangway six more passengers can be accommodated. There is a clerestory ventilated roof, and ventilators above the windows. Additional air can be obtained by folding back the top portions of side windows. Removable cushions are provided to the seats; these and the back rests are upholstered in dark green leather. This vehicle was for the Maidstone and District Company, who have twenty more of these bodies in service. Others are in use at Stafford, Wolverhampton, and Middlesbrough. Dodsons are also building 150 of the K type omnibuses for the London General Omnibus Company.

Dodson 34-Seat Body on Tilling-Stevens Petrol-Electric Chassis.

DURHAM, CHURCHILL AND COMPANY.—This Sheffield firm staged a 3-ton chassis with lorry body, having hinged sides and cab, built for the Dart Motor Transport Company, Sheffield. It had a 45-H.P. J.B. 4 Tylor engine, "Champion" metal-to-metal cone type clutch, Butler patent front axle, steering gear (irreversible) operated through worm and segment with 18-in. steering wheel, gate-change gear box, four speeds and reverse, rear axle of nickel chrome steel, the wheels being fitted with Shrewsbury and Challiner solids. The overall length is 22 ft. 6 in., wheel base 15 ft., wheel track 5 ft. 4½ in. Another 3-ton Churchill had a special short wheel base to accommodate three separate side-tipping coal hoppers, each of 8-ton capacity, this being a sixth repeat order for the Brightside Co-operative Society. The Churchills, like most other makes, are higher from the ground than was the case before the war, thus making them suitable for Colonial operation. This is of special importance when chain drive is adopted.

W. AND G. DUCROS, LIMITED.—Two "W. AND G." 2-ton and two 2½-ton chassis were exhibited. Each was fitted with "W. AND G." model engine, having a bore and stroke of 95 mm. × 140 mm., and developing 33 H.P. at 1,400 revolutions per minute, with fabric-lined cone clutch. A 3-speed gear box is fitted in the case of the 2-ton, and a 4-speed box to the 2½-ton. The cardan shaft is carried by special fabric joints which have a large safety factor, and the rear axle is a worm drive with bevel differential and floating shafts. On one 2-ton chassis was a van body with canvas waterproof hood on detachable hoops. The other had a coach de luxe, upholstered in real hide, light emerald green in colour, the body being painted green and primrose. Dunlop giant pneumatics, inflated by a pump driven from the gear box, complete a luxurious coach, entirely made at the Acton Vale Works. One 2½-ton chassis had a W.D. type body with hinged sides, ridge pole, hoops and waterproof cover. A driver's cab is provided, also glass windscreen. To the other 2½-ton chassis was fitted a steel body tipping to the rear, and easily and quickly operated by hand from either side.

FODENS, LIMITED.—From Sandbach Works, Cheshire, was shown a 5-ton steam wagon built for coal cartage for the Homes for the Aged, erected by the trustees of the late Mr. Whiteley, the universal provider. It is fitted with platform body and North British Rubber Company's solids, the rear wheels having twin tires. It was of the standard type, with a few improvements suggested as the result of the unique work performed during the past five years. The boiler of the overtype engine works at a pressure of 200 lb. to the square inch, the engine developing 30 H.P. By means of high-pressure gear, additional power is obtainable. A noticeable feature was the accessibility of the control levers. Another point was that the brake of the trailer is operated by the driver, thus doing away with the need for a man on the trailer. The drive is by chain to a live rear axle. Although the stand was under the gallery there was no lack of visitors, and at night an electric sign indicated the whereabouts of Fodens, who, as pioneers in steam wagons, were naturally looked for.

RICHARD GARRETT AND SONS, LIMITED.—This Suffolk firm now produce electric as well as steam tractors and wagons. A 3½-ton electric had a brewer's type body, and the motor was stated to be capable of taking 300 per cent. overload. Reasonable treatment is ensured by an arrangement which requires the starting handle to be returned to the neutral position before the vehicle is restarted, thus preventing the vehicle being started at too high a speed or too much energy being applied. The No. 5 Garrett non-superheated overtype steam wagon was similar to 18 ordered by the London and North Western Railway Company. It had a hinged side body. The wagon takes a 5-ton load and draws a trailer of 3 ton capacity. Henley tires were adopted on both the electric and steam vehicle, but for the No. 4 Garrett compound saturated steam tractor giant Macintosh solids are utilised. Other exhibits were a 6-ton side-tipping trailer wagon, and a sleeping van for three men.

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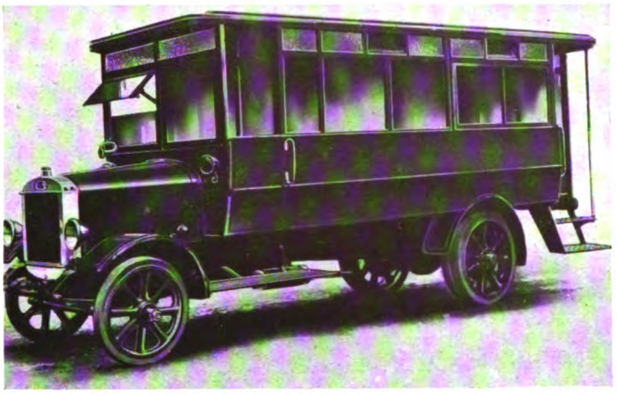
GUY MOTORS, LIMITED.—The specialty from Wolverhampton was the 2-2½ ton chassis introduced this year. In one instance it was fitted with a single-deck omnibus, a body seating 26 passengers, and having the merit of being most pleasing in appearance. The whole length of the body is provided with iron plates and bumper mouldings, the rear platform being panelled inside and outside in sheet steel. A sliding door running on ball bearings is provided at the end of the gangway. For passenger work the chassis has a wheel base 2 ft. longer than for goods carrying. Features of the machine are the ease with which adjustments can be made and the mounting of the engine and gear box on a three-point suspension, which gives immunity from distortion of the main frame and road



Guy 25-h.p. Omnibus, Seating 26 Passengers.

shocks. The speed governor, which has hitherto been a feature of Guy vehicles, has disappeared. This is because of the practice of drivers cutting out the action of the governor in these days of a desire for speed. The engine has four cylinders, cast in monobloc, and having 25 H.P. For industrial work a chassis was shown fitted with twin-screw tipping wagon body and cab for driver. As in the omnibus, the C.A.V. lighting equipment was installed. This vehicle was made for Manchester Corporation. Another exhibit was a patent wheel for use on soft ground.

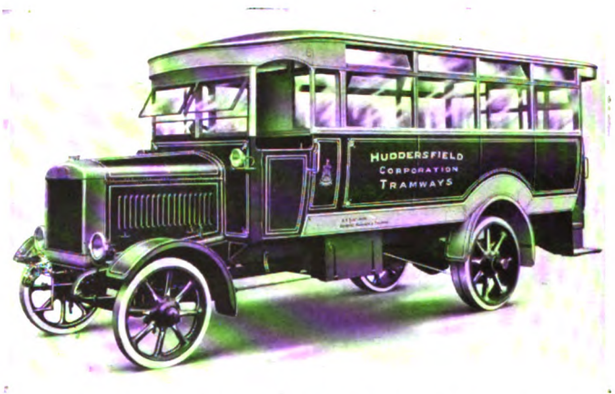
GENERAL VEHICLE COMPANY.—Three electric chassis were staged, together with units for standard equipment and spares. A 5-ton chassis was fitted with the Ironclad battery, made by the Chloride Electrical Storage Company, Limited, but Edison type can be supplied if required. A 2-ton chassis with electrically-operated tipping body was for Sheffield Corporation Cleansing Department, and is provided with canvas curtains. A 1-ton electric chassis with special van body and Goodrich pneumatic tires, was for the Royal Asylum, Montrose. Motor generator equipment was shown separately. The G.V. has a British Thomson-Houston all-enclosed motor, capable of 300 per cent. overload capacity up to 30 minutes, which renders it especially suitable for hill climbing. The motor is hung from a bar pivoted to the side frame. An enclosed Morse silent chain effects transmission to the countershaft, with roller chains to the rear wheels. Internal expanding brakes operate on each of the rear wheels, and emergency brakes act on the countershaft. The vehicles are built at the company's works at Birmingham, and are rapidly finding favour on account of their reliability.

J. & E. HALL, LIMITED, Dartford, Kent, makers of the well known "Hallford" machines, had five examples of their products on view. These ranged from a 5-ton chassis fitted with a tipping body to a business-like meat van of 2½ tons capacity, built for the Crown Agents for the Colonies. The 5-ton tipping wagon is operated by hydraulic gear and is one of a large number to be supplied to the Singapore municipality. The bare 4-ton chassis attracted considerable attention from visitors, and it enabled them to note the robust design of all its working parts and to understand something of the reason for its fine record. The engine is rated at 40 H.P. and has a bore and stroke of 110 and 140 mm. respectively. The cylinders are cast in pairs and have the valves on the left-hand side. The engine and gear box are mounted on a separate sub-frame. Four speeds and a reverse are provided for. The final drive is by chain, the countershaft being enclosed in a separate casing, the mechanism of which is connected with the gear box by a short propeller shaft. The other exhibits consisted of a 4-ton lorry with a lift body built to the order of A. Bishop and Company, removal contractors, and a 3-ton van, which in itself was an excellent example of the coach builder's art.

HALLEY'S INDUSTRIAL MOTORS, LIMITED.—This noted Glasgow firm showed their standard chassis of 3-3½ tons, with 35-H.P. engine of six cylinders, upon which they have concentrated since it was exhibited at the Scottish Exhibition. The engine gives automatically a safeguard against excessive speed without employing a governor. At any speed exceeding 1,250 revolutions per minute there is a rapid decrease in power. A single plate clutch, four speeds forward and reverse gear box, worm-driven back axle, roller bearings throughout, and an electric lighting and starting set are other features. One chassis was shown with 37-in. × 7-in. single Goodyear pnematic tires on the front wheels, and 44-in. × 10-in. single pneumatics on the rear, and on this account attracted a considerable amount of attention. Lubrication of the gear box is by a special type of cup projecting from the frame, with a chained lid. A device is provided for observing the amount of oil in the box. On another chassis was an end-tipping lorry body, hydraulically operated. The most notable use of the Halley standard chassis was for a 29-seat torpedo coach de luxe, painted primrose, and having an electric lighting set. The tires were Dunlop solids. In the braking equipment of the Halley the rear wheel brakes operate in open-sided drums, allowing for easy inspection.

E. AND H. HORA.—Edinburgh Corporation Tramways are utilising bodies by the Peckham Road firm for their motor omnibuses. The specimen shown was on an A.E.C. 4-ton chassis, with seats for 37 passengers. It was built on tramway car single-deck lines, with a sliding dividing door at the rear; also a door at the front which could be used for exit by lifting up a seat adjoining the driver. The gangway is wide, with transverse seats, the rear part of the saloon being for smokers, with seats facing inwards. This style of body fitted to a London General Omnibus was shown at the Antwerp Exhibition. The driver is partly partitioned off by a glass screen, to which blinds are fitted for averting reflection from the rear at night. Electric lighting is available. Besides the usual roof ventilation there are drop windows in the centre, and a sliding window to the door at the front end. The lower exterior is in lake and cream, embellished with gold and red. Owing to the strike in the coach building trade this body was shown in an unfinished condition. We hope to publish an illustration of it in a later issue. Another Olympia exhibit was a lift van furniture removal body on an A.E.C. 45-H.P. chassis. As an example of the firm's work as wood benders, a 2-in. thick piece of ash had been bent at four angles.

KARRIER MOTORS, LIMITED.—Tramways and omnibus managers were interested in the single-deck omnibus made for Huddersfield Corporation Tramways department. There were many special features in the roomy body, constructed by the General Seating



A New Karrier Chassis with Hickman's Patent Body.

Company on Hickman's patents, seating 36 passengers. The extraordinary lightness is remarkable, and the rigidity of construction is secure by locking every joint by means of a special form of construction. Huddersfield Corporation have placed an order for a series of these omnibuses, single and double deck. Both have absence of top overhang, an advantage on a road having a pronounced camber. The K.4 chassis is the new type Karrier fitted with an engine manufactured throughout at the Huddersfield

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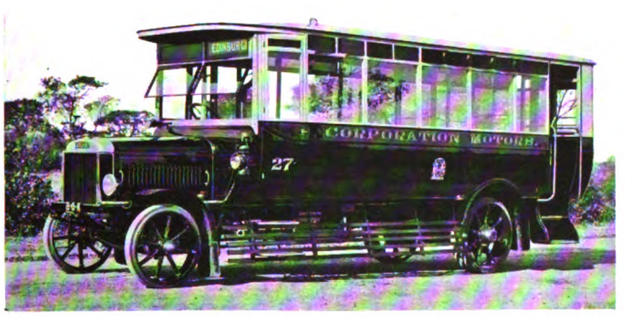
works. It will be interesting to watch the performance of these vehicles in view of the hilly nature of the district. The vehicle has Dunlop solid tires.

A unique body was shown on the 3-4 ton lorry chassis. The space available made it impossible to exhibit a complete range of the Karrier types, and the company solved the problem by fitting one chassis on a lorry body which had detachable sides of three distinct patterns. The floor boards were partly covered to show the double floor which is a specialty for brewing trades, and a part left with a platform as supplied for various haulage purposes. Another part of the floor was covered with sheet steel, as fitted on tipping bodies. As with the other exhibits, there was a high grade of finish on this vehicle.

A third exhibit was the Karrier Superbe coach, seating 30. Michelin giant pneumatics were fitted, single in front and twin rear. The standard equipment, however, has cast-steel wheels with solid tires; pneumatics are supplied at a slight extra charge. Not only was the coach work unique in design, but its finish was remarkable; the upholstery and painting being exactly as on highest grade private cars. The bonnet of polished aluminium gave the car a very finished appearance. The radiator was of a new design, highly polished. An electric lighting equipment was fitted as standard, the lamps being manufactured for Karrier Motors.

Huddersfield Corporation were also the purchasers of the Karrier patent road sprinkler, sweeper, and refuse collector. This machine slacks the dust with water, sweeps a width of 7 ft. 6 in., and automatically picks up the sweepings. When the hopper is full, the vehicle can be driven to the tip.

Leyland Motors, Limited.—This stand worthily upheld the company's reputation for public passenger, pleasure, and commercial vehicles, and their notable fire fighting machines. One of a number of single-deck omnibuses which they are supplying to Edinburgh Corporation Tramways department was generally remarked upon. Although this 4-ton vehicle seats 33 passengers, it is commendably light in appearance. It has the merit of having both rear and front doors; thus the driver is not completely shut off from the saloon if he should happen to need aid. A glass screen extends across half of the width of his compartment on his left. The omnibus has a 36-40 h.p. engine of four cylinders cast in pairs, the Leyland standard practice. There is a 4-speed gearbox and worm-driven rear axle, and C.A.V. electric lighting is provided. As in all the



Leyland 33-Seat Omnibus for Edinburgh.

Leyland models, the chassis frame is of pressed channel steel of deep section, adequately trussed. Clincher solids are fitted to the wheels.

A 5-ton brewer's lorry with cab had an engine of 40-48 h.p., specially designed for heavy work. It has four cylinders, 5 × 6 in. bore and stroke, cooling being assisted by an eight-bladed fan in place of the four blades used on other models. There is a four-speed gearbox, but the drive is by a bevel and spur double reduction rear axle. Dunlop solids are fitted. The machine can be had with a wheelbase of 15 ft. 10 in. for 6-ton loads.

Mid-Rhondda Traction Company are the owners of the 3-ton chassis (30-32 h.p.) which was shown fitted with a 23-seat de luxe coach body with neat folding hood. Michelin pneumatics, single in front and twin at the rear, Smith's electric lighting set, comfortable seating in green leather, and ample leg room render the body the equivalent of its title. The fire engine and escape had the standard 500-gallon Rees-Roturbo pump, worked by a 65-h.p. engine. It has a bevel rear axle, four-speed gearbox, Shrewsbury and Challiner cross-ribbed tires, and C.A.V. self-starter, and was inscribed with the name of the Broadstairs Brigade.

J. Liversidge and Son, Limited.—Five examples of this London firm's capital body work comprised a commercial traveller's pneumatic-tired omnibus on a Ford chassis, a lorry body on Burford chassis (for which numerous orders were notified), a box body van on an Albion chassis, and two examples of van bodies before painting. A feature of all was the good shelter for driver.

Maudslay Motor Company, Limited.—A variety of uses was indicated by the exhibits on this Coventry firm's stand, namely, omnibus and coach traffic, haulage by means of a 5-ton side tipper with special low loading level, and haulage of long steel bars or

Maudslay Saloon Omnibus Seating 38.

bulky goods on a special 6-ton chassis. The Maudslay omnibus is very roomy, accommodating 32 persons in the saloon, four on the rear platform, and two by the side of the driver. The body is the improved type by Hickman, built by the General Seating Company. It is electrically lighted and the upholstery is in leather. The new type J chassis has an engine of 40 h.p., giving 7 to 8 miles to the gallon of petrol. A feature of this engine is that although the cylinders are cast in pairs, the water jackets are connected, while an improvement in the exhaust pipe lessens the restriction of the flow of the gases. The crank case is suspended on a special rolled steel sub-frame by six-point suspension, and by means of inspection doors the pistons and connecting rods can be taken out without removal of the cylinders. Water circulation is by centrifugal pump. The induction pipe of the Zenith carburetter has a water jacket. The frame is of very rigid construction, and the engine and gear box are attached to a sub-frame. Transmission from the engine to the gear box (four speeds and one reverse) is by a clutch shaft with universal joints. The Maudslay banjo steel forging is incorporated in the rear axle, and the final drive is by overhead worm. The wheel base is 15 ft. 6 in. The coach body has a similar chassis and engine, with 14 ft. 6 in. wheel base. It was made for a Birmingham firm. The 6-ton vehicle is for the Coventry Corporation.

McCurd Lorry Manufacturing Company, Limited.—A medium size single-deck omnibus, seating 26 passengers on luxurious leather seats, was exhibited on this firm's 4-ton chassis, which was also shown as a unit for lorry work. The omnibus was for the Ortona Motor Company, Cambridge. Similar vehicles are also run in County Down and elsewhere. The body, a fine specimen of the coach builder's art, by T. Pass, Limited, of Coventry, was built to the McCurd Company's design. Up-to-date construction was denoted by doors on the near side rear, and front, the driver having an entrance on the off side, therefore capable of being operated on the front exit plan. The C.A.V. lighting equipment is installed, and solid rubber tires are fitted. The McCurd chassis has a 40-h.p. engine of four cylinders, cast in pairs, the bore and stroke being 4½ in. by 5½ in. For strength and compactness this chassis was one of the most noteworthy in the exhibition, and it embraces a number of improvements resulting from several years' use for passenger and commercial use. It has been extensively operated by London and Edinburgh biscuit manufacturers. In the improved model the accessibility of the water circulating pump, the magneto, and the back axle are good points. The axle case is of very sub-

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stantial proportions and designed to give such strength that no tie rod is necessary. The differential, of the spur wheel type, is said to be practically indestructible. The worm wheel is bolted to the differential case in such a manner that side stresses on the bolts are avoided. The worm, which is of steel, is mounted on very large ball races. The whole of the internal mechanism of the axle can be taken out without removing the road wheels or disturbing the load. The worm is of the overtype, and arranged to give a straight through drive from the engine to the back axle when the vehicle is loaded. The frame is of high-grade pressed steel, channel riding and low maintenance costs. There is overhead worm final drive, the worm and worm wheel being removable without interfering with the whole axle. The folding roof of the coach body is an innovation in a fine example of Jas. Bartle and Company's body construction, the windows being of the drop and noiseless pattern. Sliding tables and electric lighting are also provided. The coach seats 29 persons, and it has a sliding entrance by the side of the driver. Painted Minerva blue, upholstered in black leather, and running on Michelin pneumatic tires (twin to the rear wheels), the vehicle is the acme of luxurious travelling.

McCurd 4-Ton Chassis Fitted with 26-Seat Body.

section, the whole being bolted with steel bolts, no rivets being used for that purpose. The general dimensions are—Length overall 20 ft.; width 7 ft. 1 in.; body space 15 ft. 4 in. (the distance from the dash to the end of frame), 12 ft. without overhang, this being the distance from the back of the driver's seat to the end of frame; width of frame 3 ft. 2½ in.; standard wheelbase 14 ft. 6 in., standard track 5 ft. 6 in. Wheel base and length of frame behind dash can be varied to suit special requirements.

Palladium Autocars, Limited.—The two 40 h.p. 4-ton chassis, one without a body and the other with a corridor all-weather coach

Standard Palladium Chassis.

saloon, were of the type which has been described in previous issues. The most notable feature is the twin cantilever springs on the rear axle of the coach, a device giving the smoothest possible

Ransomes, Sims and Jefferies, Limited.—Orwell electric vehicles were shown on this stand, together with a new steam wagon. The latter was a 5-ton wagon of the overhead type, with a special locomotive boiler with circular dome-topped firebox, which eliminates the need for stays.

The electric vehicles comprised a 3½-ton tipping wagon and a 2-ton machine having separate motors driving the rear axle through roller chains, the sprockets for which are driven by a geared countershaft carried below the motor casings. The tipping wagon was fitted with a separate electric motor to operate the tipping mechanism which is of the horizontal worm variety.

Saurer.—The stand of the Société Anonyme Adolphe Saurer, of Arbon, Switzerland, constituted what may be termed the "show" exhibit of the exhibition. This was on account of a lorry with novel tipping capabilities and also because of the high finish imparted to a 2-ton chassis for exhibition. The company is new to the industry in this country, but it has figured as first prize winner in French competitions from 1908 onwards, and from 1914-19 placed all its output at the disposal of the French Government. This year it came first and second among the 28 entries from 46 competitors in the Barcelona-Madrid trials for lorries of over 3-ton capacity. In various international trials Saurer vehicles have gained 47 first prizes, diplomas, and medals.

The "Universal Commercial Vehicle" takes a load of 5 tons, and its tipping body has the following features—Ability to discharge load on three sides at an angle of 45 degrees; to keep the body tilted at any desired angle; impossibility of any uncontrolled tipping; tipping mechanism hermetically enclosed for protection from foreign matter; automatic opening of the racks, great simplicity of the mechanism, and ease of keeping in working order. The tipping apparatus can also be used to spread a load in a uniform manner while the vehicle is travelling. The iron body is lighter in weight than a wooden body of like capacity. It is fixed to the chassis by means of four round-headed supports. A lever at the side of the driver unbolts the body before tipping, and a second lever controls a pump which forces oil into a steel cylinder containing a piston, the action of which tilts the body. The lateral and rear racks work automatically as soon as an angle of 25 degrees is reached. Safeguards are provided against accidents that might result from inexperience or carelessness.

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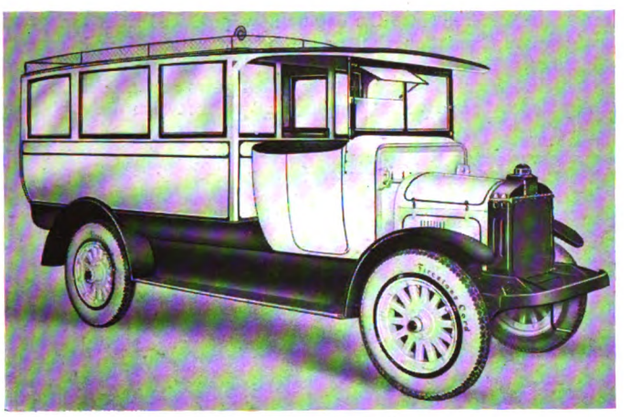
Other exhibits were the 2-ton chassis already referred to, and a 5-ton lorry. The former has an engine of 32 H.P., and the latter 40 H.P. Each has four cylinders in monobloc, engine and gear box being on a single unit with three-point suspension. The revolutions are restricted to 1,000 per minute by a centrifugal governor, and the compression can be utilised as a brake. A cardan shaft transmits the energy to the bevel-driven rear axle. Due regard is paid to accessibility. It is claimed that the petrol consumption registered by a Saurer 3-ton vehicle in the 1908 French competitions was a record, and that it has not yet been beaten.

RICHMOND MOTOR LORRIES, LIMITED.—The display of 30–40 cwt. Wallace lorries was distinctive in chassis and bodies. The latter was the work of ex-service men trained under the auspices of the Ministry of Labour. Particulars of the chassis and of its hill climbing capability under a full load have already been given in this journal.



Wallace Omnibus for 20 Passengers.

The chassis was shown with a 20-seat coach body, fitted with folding table in centre, and also with a station omnibus body to seat 14. Both passenger vehicles had giant pneumatics. The coach had a luggage platform fitted with loading gear. For industrial work there was a lorry fitted with tipping body, the tipping gear being Bromilow and Edwards' patent, actuated by engine power. The "Wallace" power on hills is largely due to the design of the rear axle assembly. The spur gearing, which is the system employed, is claimed to be the simplest form of gear for carrying out speed reduction. All the driving torque is set up at the wheels, and not at the centre of the axle. A feature is the method of suspension, the springs being of special design, and extra length. Provision is made on all chassis for the fitting of a self-starter and electric lighting set. The rear axle transmission and the engine were shown in sections.

SCAMMELL AND NEPHEW, LIMITED, of Spitalfields, E., attracted the attention of all visitors interested in heavy haulage, for the Scammell six-wheel machine is undoubtedly a welcome addition to road traction possibilities, where economy of time and cost are prime factors of consideration. The type of vehicle shown on this stand was designed to carry a load of 7½ tons on its own body and to haul a further load of 6 tons on a trailer. It is fitted with a 4-cylinder engine developing 47 H.P. at 1,000 revolutions. The cylinders are cast in pairs and have 5-in. bore with 5½-in. stroke. Overhead valves operated by adjustable plungers with rocking levers are fitted, the whole valve mechanism being enclosed in dust-proof aluminium covers. Large bearing surfaces is a special feature of the engine, which, together with the gear box, is mounted upon a sub-frame upon the three point suspension principle. Forced circulation is provided for the cooling system. A distinct advantage of the six-wheel vehicle is the low tare weight in comparison with the loads carried and the even distribution of the load over the three axles.

SENTINEL WAGON WORKS, LIMITED.—An imposing array of steam wagons filled the large stand occupied by this Shrewsbury firm, no less than six vehicles being staged of various capacities. One of the most interesting of these was a 3½-ton hydraulic tipping wagon built to the order of the Tunbridge Wells Corporation, the tipping apparatus of which is operated by a steam injector.

THE STAR ENGINEERING COMPANY, of Wolverhampton, staged four vehicles—a 50-cwt. tipping wagon fitted with the firm's own tipping gear, a 3-ton chassis, a 30-cwt. bare chassis, and a 30-cwt. delivery van. Each of these machines had a similar type of engine, viz., 4-cylinder, 90 × 150 mm. bore and stroke, with pump water circulation. In the 3-ton and 30-cwt. models the final drive is by means of worm gearing, but in the 50-cwt. chassis a bevel wheel and pinion with double reduction gear is the method adopted. A four-speed gear box is fitted to each type of machine; this is separately mounted upon a sub-frame, a flexibly-jointed shaft connecting the driving shaft with the cone clutch. Dunlop pneumatic tires were fitted to the delivery van and 30-cwt. chassis.

STRAKER-SQUIRE, LIMITED.—Evidence of the good results achieved from concentration of this company's energies in the Government factory which they purchased at Edmonton, were apparent on Stand 58. Here were the results of standardisation in the new "A" type chassis, upon which three types of body were shown. Then the 25-seat rear entrance single-deck omnibus there was not a more conspicuous object in the exhibition. It was built for Plymouth Corporation Tramways Committee, who have placed an order for 20. By the use of gangway seats seven extra passengers can be accommodated. Interior lighting is by C.A.V. electric installation. Entrance is at the rear, with a separate door behind the dash for the driver, who is enclosed. Ventilation should be perfect, for in addition to the five top apertures on each side two windows on each side fold down. Safety guards can be provided to the rear wheels as an extra.

A few of the salient points of the unique 3–5 ton chassis may be enumerated. The load mentioned is exclusive of a reasonable body weight. The engine, of 55 H.P., has four cylinders cast with top half crank base *en bloc*, with detachable cylinder head, forming valve and combustion chamber. Water circulation is by thermo-syphon, assisted by a two-bladed propeller in the water inlet pipe. Cam shaft and magneto shaft are driven by special Hans Renold silent chain, adjustment for wear being provided by moving the magneto bracket with its bearings along the slotted holes. The crank shaft is of massive proportions, composed of nickel-chrome steel, heat treated to give 60 tons per square inch tensile strength. Ignition is by high tension waterproof magneto, fitted with impulse starter, which ensures a fierce spark, irrespective of engine speed. The clutch has a very efficient stop, making the gear-changing as smooth and shockless as on a touring car. Smith's four-jet carburetter is bolted direct to the cylinder head, being heated by the exhaust, which also passes under the inlet manifold, ensuring quick heating up and rapid evaporation. The gilled tube radiator has a four-bladed fan, the boss of which also drives the two-bladed screw propellor, which assists the water circulation. The gear box

One of Twenty Single-Deckers for Plymouth.

has short stiff shafts running on roller bearings, four speeds forward and reverse. The gate box is carried by an arm bolted directly to the gear box, and twisting of the main frame has no effect on the change-speed mechanism.

The gears are of 110 ton steel, and the lay shaft is provided with an extension to which a coupling can be fitted if desired, to drive labour-saving appliances on the chassis. Engine and gear box are mounted on an exceedingly stiff underframe, suspended from the main frame at three points only. This provides absolute alignment of engine and gear box under all conditions, dispensing with universal joints between clutch and gear box. The whole of the clutch

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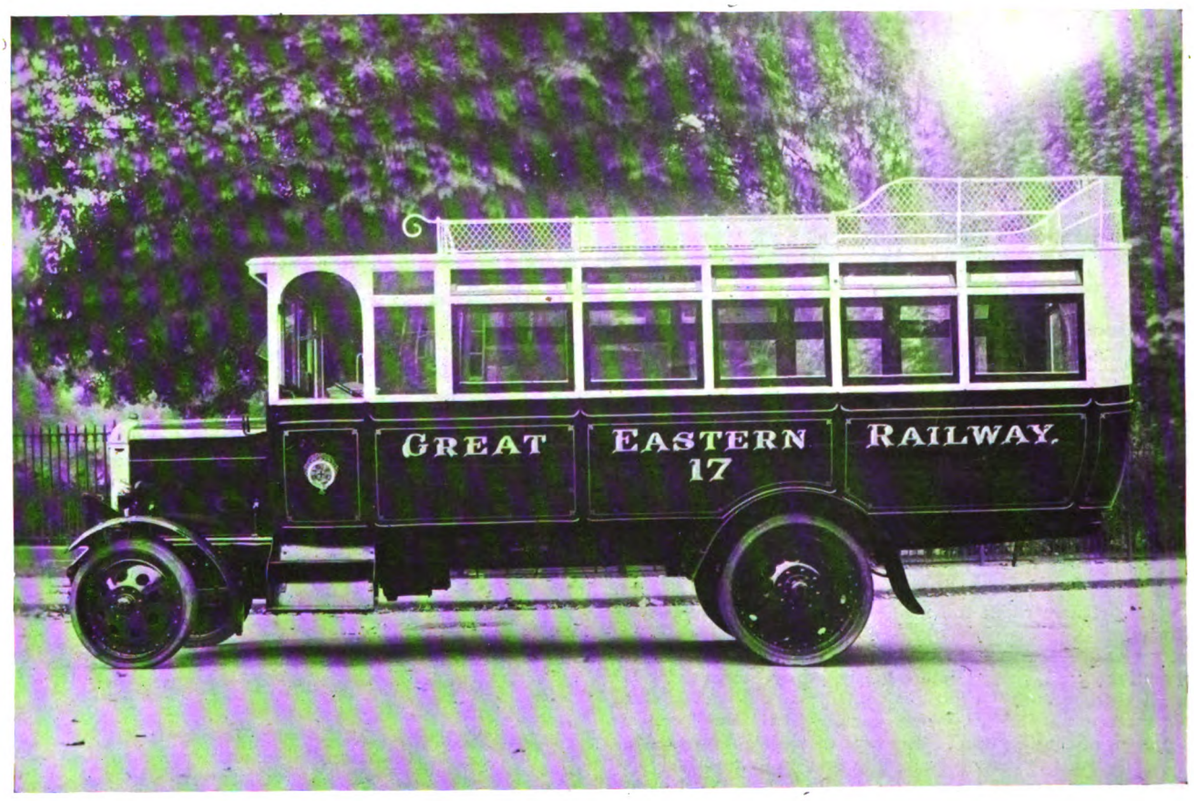
mechanism or crank shaft and fly wheel can be taken down with ease. The rear axle is of the worm and worm wheel type, running on rolled bearings and ball thrusts.

During the company's many years' experience of this form of transmission, they have never had an occasion to make a replacement as the result of wear and tear. This is accounted for by the large diameter of both worm and wheel and the coarse pitch of the teeth, combined with the care taken in hardening and machining. The springing shows a remarkable advance. The rear springs take the driving torque and thrust, eliminating parts and wearing surfaces involved in the torque and radius rod system. The front axle is an " I " section drop stamping made in special steel. As a result of the design of both front axle and steering gear, it is claimed that this chassis is remarkably easy to control, and causes the driver less fatigue than any other 5-ton chassis.

The chassis was also shown without a body. The same type can be fitted with a 46-seat double-deck omnibus body. Another exhibit on an " A " chassis was the Straker-Squire gully cleaning wagon, in use by numerous local authorities.

John I. Thornycroft and Company, Limited, 10, Grosvenor Place, S.W.—The four Thornycroft vehicles on a stand in the centre of the building formed an exhibit which created great interest. These vehicles, and also the Thornycroft type " J " 3½-ton box van which was being exhibited on the Bristol Carriage and Wagon Company's stand, were sold some time before the opening.



Thornycroft Railway Type Omnibus.

The 30-h.p. Thornycroft type " BT " worm-driven 30-35 cwt. van was one of a number ordered by the London and North Western Railway Company. This chassis, which is of a new design, is of the same carrying capacity as the old 20/24-h.p. type " BT " chassis, but is brought up to date and is fitted with an entirely new engine. This engine is of the monobloc type, with a loose cylinder head. The valve gear had been rearranged to provide a more compact combustion chamber suitable for a higher compression by mounting the inlet valves over the top of the exhausts. The engine generally is of neat external appearance, the valves and governor being completely enclosed. The starting gear is integral with the engine, and is provided with ball bearings and a rigid shaft, which makes this engine extremely easy to start up. Another change on this chassis is that the width of the springs has been increased, the change resulting in a very easy running vehicle on all types of roads.

A 40-h.p. Thornycroft type " X " motor coach, fitted with pneumatics and with seating accommodation for 28 passengers, was sold to Messrs. R. E. Hale and Company, of Newcastle-on-Tyne. A feature of the body was the large compartment arranged for luggage. The vehicle was upholstered in real leather, and visitors closely scanned the Bartle patent divisible one-man hood with which it was fitted. When used for general haulage and fitted with an open lorry body, the type " X " vehicle carried a load of three tons, or 2½ tons in a box van body. This type, and the larger types " J " and " Q," are fitted with the Thornycroft 40-h.p. vehicle engine, which has proved so remarkably successful in service. The only notable change made since the war in the design of the engine, and which differentiates the engine now produced from the 40-h.p. engines used throughout the war, is the new position of the lubricating oil pump. This is now arranged near the oil level in the sump, and driven from the camshaft by spiral gears and a vertical shaft. A double leather universal coupling is fitted between the engine and the gear box, which effects an improvement both by enabling the clutch to be more easily dismounted, and also by providing a more flexible connection eases very greatly the effort required to disconnect the clutch.

Two examples of the 40-h.p. Thornycroft type " J " vehicle were on view, this being the famous War Office model, of which 5,000 were supplied to the War Office during the war. One was a single-deck omnibus to seat 28 passengers, sold to the St. Ives and District Motor Service. Accommodation for a further six passengers can be provided by the addition of gangway seats. This vehicle also is upholstered in real leather and equipped with electric lighting set and self-starter. The other type, " J," is a Thornycroft tipping wagon, part of an order placed by the county borough of Eastbourne. This vehicle carries a useful load of 3½ tons, and is equipped with Thornycroft hydraulic tipping gear driven from the engine. This vehicle can be supplied with a 750-gallon watering tank inter-

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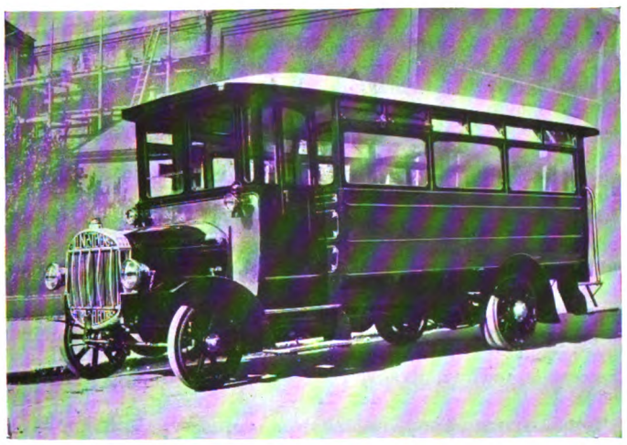
changeable with the tipping body, thus forming a double purpose vehicle of special interest to municipal authorities and others. If fitted with an open lorry body, the " J " vehicle will carry 4 tons. The hydraulic tipping gear fitted to one " J " type is of Thornycroft manufacture, and is designed to replace the hand tipping gear where a mechanically operated tipping gear is desired. The fluid employed for operating the piston is oil, and is pumped by a neatly-arranged gear pump driven from the after end of the camshaft by means of chain gear.

Lack of space prevented the exhibition of the largest Thornycroft vehicle, the 40-H.P. type " Q," with a carrying capacity of 5 tons, but its technical features are similar to those of the type " J " vehicle, including a worm-driven axle, which for some years has been the standard practice on all Thornycroft vehicles, an example that is now being more widely followed, as its merits over chain-driven transmission have become definitely established. It is noteworthy that the winning vehicle in the Rhine Army Show held at Cologne in 1919 was a " J " Thornycroft which had been sent to France in November, 1914, and employed continuously throughout the war.

TILLING-STEVENS MOTORS, LIMITED.—From the Maidstone Works, which were recently considerably enlarged by the opening of a model extension, three very notable exhibits were staged. In each exhibit improvements had been effected, indicating that in both petrol-electric and petrol vehicles the company are alert to secure progress. Their petrol-electric machines have substantiated the claim of long life, low maintenance charges, smooth running and control, and certain hill climbing.

In the petrol-electric omnibus world the latest order is four vehicles for Douglas Corporation. The most notable object on the stand was the standard petrol-electric chassis fitted with a superb single-deck body, finished in bright red with gold lining. The 40-H.P. engined chassis had been slightly modified to allow a body with a larger passenger carrying capacity to be fitted. The extra space available for seating is brought about by placing the steering outside the main frame, and increasing the wheel base from 14 ft. 6 in. to 15 ft. 6 in. As a result of these improvements comfortable seating accommodation is available for 32 passengers. By means of doors both in the front and rear there can be simultaneous loading and unloading, thus helping to speed up traffic. The interior was divided into two compartments, the front seating 19 passengers and the rear (for smokers) seating 13. A separate self-contained compartment for the driver is accessible only by a door on the off side. The upholstery was in rattan, the seats being well sprung and very comfortable. Efficient ventilation is ensured by a high semi-elliptical roof and drop windows operated by suitable controlling



Tilling-Stevens 40-h.p. Omnibus with Front Exit.

gear at the conductor's end, and under his direct control. C.A.V. lighting was installed. Both the chassis and body were designed and constructed at the Maidstone Works.

The Tilling-Stevens 50-H.P. 3-4-ton petrol electric chassis shown was the standard post-war model. The engine, supported on a sub-frame having three-point suspension, had four cylinders, 5 in. diameter bore, with a stroke of 6 in. The crank case was constructed so that the bottom half can be removed without disturbing the alignment of the engine. A further improvement on earlier models was effected by the introduction of internal instead of external dynamo and motor cooling fans, which allows the commutator end cover to be removed without interfering with the fan.

Another exhibit was the Tilling-Stevens 2½-ton petrol gear-driven chassis. This is standard post-war type ,but with various improvements fitted. The 25-30 H.P. engine, mounted on a sub-frame having a three-point suspension, had four cylinders 105 mm. diameter bore and stroke of 125 mm. As in the case of the post-war petrol-electric model, the bottom half of the crank case is removable without disturbing the alignment of the engine. The clutch had been re-designed, with all moving parts made as light as possible consistent with strength. By the provision of a double universal joint between the clutch and gear box, the clutch is made self-aligning. A C.A.V. self-starter, operated in conjunction with C.A.V. electric lighting, had been fitted to the engine. The engine also has a mechanical governor. A fourth exhibit comprised complete front and rear axles demonstrating the axle for this petrol type of chassis adapted for and fitted with pneumatic tires.

VULCAN MOTOR AND ENGINEERING COMPANY (1906), LIMITED.—The far-seeing heads of this company (Southport and General Buildings, Aldwych, W.C.2) have introduced a 30-cwt. chassis of

One of a variety of uses for 30-cwt Vulcan Chassis.

distinction, and are to be complimented upon the variety of uses for which they are making it available. To mention one vehicle in the latter connection, the station and hotel omnibus is also of value to municipal authorities. Glasgow Education Committee have eighteen in use. It is priced at £1,100 complete with pneumatic tires. This vehicle, which seats 14, should be of great utility to committees who have visiting to perform. Electric lighting is provided. There is good luggage capacity, and the driver is well sheltered.

For omnibus work and also for three other purposes denoted by the exhibits on the stand, the Vulcan chassis has been standardised for quantity production. The engine is of 20 H.P. (90 by 130 mm.). The chassis, fitted with a coach body, carries 20 passengers, and it has pneumatic tires and electric lighting. Special attention has been paid to comfort, the seats being well sprung. A full-width windscreen is provided, the top half of which on the driver's side is made to swing out, and the cape hood is easily operated.

Another notable Vulcan was a tipping wagon. The lorry body, of steel, measured 8 ft. 4 in. by 5 ft. wide by 21 in. deep, and is specially designed for carrying any products that can be tipped. The gear is operated by the engine, which drives two hydraulic rams. The body is raised or lowered by the movement of a lever without the driver leaving his seat. The average time taken to clear a load is 30 seconds. The rear door, hinged and pinned at the top and bottom, can be opened either upwards or downwards. The driver's cab had full length doors and windows that can be lowered.

A fourth exhibit was a farmer's wagon specially designed for farm produce. The 30-cwt. Vulcan is built on substantial lines embodying the best practice. The cooling water is circulated by pump, and lubrication is forced to all main bearings. Ignition is by high tension magneto, which is placed in a very accessible position. The carburetter is a Zenith, which gives excellent slow running results and is very economical in fuel. Power is transmitted through a Ferodo-faced cone clutch to the four-speed gear box, which is operated by the central type of gate change. A full floating type of rear axle is employed, the final drive being by worm. The steering, by worm and worm wheel, is very light in action. Semi-elliptic springs are fitted throughout.

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WALKER BROTHERS (WIGAN), LIMITED.—By this old-established Lancashire firm four samples of their "Pagefield" machines were staged—one passenger vehicle, two industrial vehicles, and a bare chassis. The char-a-bancs, well designed, with seating capacity for 28 passengers, was fitted to the standard 3-ton Pagefield 40-H.P. chassis. This has a Dorman engine and a four-speed gear box in which the second, third, and fourth speeds are in constant mesh, engagement being by means of dog clutches. The final transmission is by worm and worm wheel, the latter being bolted to the differential cases, through which it transmits the power to the driving axle. The bare chassis shown was the 3-ton standard known as the "F" type. The special "K" type was fitted with a mechanically-operated and automatically controlled tipping gear, designed to handle loads of 3 tons. This machine is similar to the "F" type, but is constructed with a short wheel base, and although useful for many other purposes is specially suitable for tipping wagon bodies. The other machine was the 5-ton type "W," also fitted with a tipping body. It has a 50-H.P. Tylor engine, and the transmission from the four-speed gear box is by means of a universal jointed shaft to a bevel pinion carried in a case bolted to the weight-carrying axle. This pinion meshes with a bevel wheel which is bolted to the differential case, and transmits power to the driving axles through two pairs of spur pinions and wheels. Pagefield machines have been well tested in many parts of the country, and the makers have good reason to be well pleased with the reputation they have earned for reliability and economy.

YORKSHIRE COMMERCIAL MOTOR COMPANY.—The 3-4-ton "Yorkshire" was fitted with patent mechanically operated end-tipping body, rubber tires, and three-speed gear. The 9-in. water level above the firebox prevents burning and leaks; and the excellence of the circulation and large heating surface with short length of tubes allows steam to be maintained under the worst conditions. The exhaust is silent and invisible, and no sparks are emitted from the chimney. The vertical compound engine works at a pressure of 200 lb. to the square inch, and the two-speed live back axle is chain driven. The differential is enclosed in an oil bath. The rear axle is built of forgings and stampings throughout. The bevel and pinion wheels are of mild steel stampings, with machine-cut teeth properly meshed with the bevel sleeve wheel. Other improvements are superheaters fitted in chimney base to ensure dry steam being admitted to cylinders, and improved rear axle and foot brakes, giving accessibility and rapid adjustment. The vehicle was built for Guildford Corporation. The body is one of a variety available, ranging from a watering wagon to an oil tank, and with a trailer 10-ton loads can be dealt with.

ACCESSORY, COMPONENT, TIRE AND WHEEL SECTIONS.

ALLEN-LIVERSIDGE, LIMITED, had a most comprehensive exhibit of their lighting system by means of dissolved acetylene. Included were special designs for commercial vehicles, complete in all details, separate head, side and tail lamps, generators of various capacities, roof lamps for omnibuses, dissolved acetylene cylinders for commercial vehicle lighting, garage inspection lamps and complete lighting sets for garage or road use. The standard types of lamps shown were all of robust construction, being in cast aluminium and excellent finish.

THE ANGLO-AMERICAN OIL COMPANY'S stand was devoted to the exhibition of their self-measuring pumps and other apparatus in connection with storage of petrol and oils in bulk. The bulk storage installation consists of a self-measuring pump connected to an underground tank, which not only ensures safety of the store in bulk but elimination of waste, together with ready and accurate supply at all times. Several types of pumps were shown, with varying capacity, and suitable for use in inside and outside positions. In each case the delivery was controlled, so that only a pre-determined quantity would be raised irrespective of the speed of the pump handle. In the larger sizes suitable for depots for the sale of petrol in varying quantities, an indicating attachment is fitted, which automatically registers the quantity delivered to each customer as well as the gross quantity passed by the pump at any given period. The popularity of the roadside pump is rapidly increasing in all parts of the United Kingdom, replacing the petrol can in town and country. Full particulars of these installations can be had from the Pump and Tank Department, 36, Queen Anne's Gate, S.W.1.

AVON INDIA RUBBER COMPANY, LIMITED.—Here was a full range of Avon solid band tires for industrial vehicles, from the runabout electric truck to the heavy lorry or steam wagon. The Avon representatives made out a good case for the claim that in Avon solids the company have produced something which is really "different" and possesses many unique qualities. The standard commercial type Avon solid has a dome-shaped tread formation of rounded circumferential ridges, the centre one standing well up and the "shoulders" sloping away slightly, taking a graceful line into the walls. Under load it can be seen that this pattern has been designed to give efficient traction at an economical cost. There is evidence of scientific provision for compression and displacement of the rubber at the correct points, and the result is a thoroughly satisfactory design, which undoubtedly has a marked influence on the practical success of the Avon tire. An exceptionally interesting exhibit was the special grooved non-skid solid which the Avon Company designed for fire engines, and which was adopted as standard fitment by the London County Council. This tire has a square tread with clean-cut circumferential grooves, and is made of a softer rubber than that used for ordinary commercial work, but of superb quality. The result is to achieve remarkable cushioning effect and safe traction at high speeds. Though slightly more expensive in first cost than the ordinary commercial type, there would seem to be strong inducement for chars-a-banc owners to adopt this tire, not merely for its extra riding comfort but in furtherance of the "Safety First" ideal.

JAMES BARTLE AND COMPANY, LIMITED.—Messrs. Bartle and Company's stand in the gallery was devoted to the display of a number of Bartle patent fitments, many of which have become deservedly popular with motor users. Amongst these we noticed their unbreakable aluminium head lamps for commercial vehicles, "Never-skid" traction shoes for twin solid tires, "Hi-Lo" jack in four sizes, self-locking wind screen fittings, divisible hood fittings, towing hooks, etc.

W. AND A. BATES, LIMITED.—The high reputation of the "Bates" tire ensured attention to the display of solid band tires arranged on this stand. There were single and twin tires of various sizes and sections forming a complete range for commercial vehicles of all types.

BERGOUGNAN TYRE COMPANY.—This famous and old-established French firm have established temporary offices at 14-15, Warwick Street, Regent Street, W. 1. They exhibited a very comprehensive range of solid and giant pneumatic tires for use on all types of commercial vehicles. This exhibit was one of the most interesting in the exhibition, including as it did, specimens of B.G. tires of the same type as the company supplied to the Allied Governments during the war. As it is understood these were guaranteed to withstand not only the usual wear and tear of the roads, but also the recoil of the guns when fired, users of these tires will therefore obtain a very heavy mileage under ordinary road conditions. All types of guns were fitted with B.G. tires, from the famous French 75 mm. quick firer to huge 9-inch long-range guns mounted on railway trucks and weighing 40 tons. A number of enlarged photographs showed B.G. tires fitted to various types of guns. The firm also exhibited giant pneumatic tires of their manufacture, i.e., twin giant pneumatics, 955 by 155 mm.; also single giant pneumatic cord straight-sided tires 40 by 8 inch. These are also manufactured in 10 and 12 inch sections

Most interesting exhibits to omnibus undertakings were specially resilient tires as supplied to the Compagnie Generale Omnibus, Paris; a special twin tire mounted on a single steel band; and the Bergougnan patent anti-splash device, which consists of a circular rubber shield attached to the wheel. The Paris omnibus tires have 35 per cent. more resiliency than standard solids, and the cost is, roughly, about 7 per cent. more than that of standard solids.

THE BRITISH THOMSON-HOUSTON COMPANY, LIMITED.—This exhibit consisted of a well-arranged display of magnetos, impulse starters, silent timing gears, and electric lamp bulbs. In the case of the first-named, samples of various types were shown, suitable for light lorry engines, four and six cylinder, and also others for heavy vehicles. These were mounted upon pedestals and driven by electric motors, so that their characteristics at various speeds could be demonstrated. A noteworthy point in the latest type of B.T.H. magneto is the improved distributor, which renders it unnecessary for it to be removed for cleaning purposes while adding to its efficiency. It is claimed for the B.T.H. impulse starter that no matter how slow the starting handle may be turned, the engine starts on the first rotation.

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ROBERT W. COAN, Goswell Road, E.C.1, was showing a variety of aluminium castings that have for years proved indispensable in the manufacture of commercial and passenger vehicles. A prominent object was a sample of the radiator frames which the firm make for the output of Tilling-Stevens vehicles. Number plates and specimens of repairs to aluminium crank cases, gear boxes, etc., were other features. A novelty was Coan's patent aluminium step mat, which keeps clean and bright, and can be fitted in a few minutes to any footboard.

J. W. AND T. CONNOLLY, LIMITED.—In addition to a range of solid tires of the well-known resilient brand, a number of wheels of various types was shown together with such novelties as an anti-rattling device for windows and doors, windscreen edging, etc.

DE NEVERS RUBBER COMPANY, LIMITED.—Solid rubber band tires to meet the requirements of all classes of industrial motor vehicles were staged as samples of the quality turned out from the company's works at Southfields. An attractive feature of the display made, however, was the giant pneumatics which the company were showing as evidence that they are keenly alive to the great possibilities of this method of tiring commercial as well as passenger vehicles.

DRUMMOND BROTHERS, LIMITED.—A fine display of machine tools occupied the stand of Messrs. Drummond. These included a 7 in. tool room lathe, a 7 in. centre self-acting, sliding, surfacing and screw cutting lathe, fitted with milling and gear cutting attachments and arranged with self-contained electric motor drive, together with two new types with 3½ in. centres, one of which was arranged for treadle drive and the other with self-contained motor. There were also staged radial arm drilling machines, together with a bench shaping machine.

DUNLOP RUBBER COMPANY, LIMITED, London, Birmingham, &c.—Occupying one of the largest stands, the Dunlop Rubber Company's exhibits, owing to their originality, diversity, and excellence, were most attractive. It was claimed that Dunlop tires were fitted to over 50 per cent. of the vehicles in the show. The company's activities are not confined to tires and minor accessories only, for they specialise in rims and wheels as well. In this development the Dunlop Company has taken a leading position. For giant pneumatics, a type destined to supplement solids for many purposes, the company showed cast steel wheels, in which the steel felloe provides the rim for containing the tire. A wire wheel, a new departure, was shown for the air-filled "giants," lightness and strength being its chief characteristics. These tires were seen on numerous coaches and lorries in the Exhibition. Following the twin tire was the twin rim, mounted on a steel felloe band for use in conjunction with a wood wheel. Wood and wire wheels for twins made up a display that proved attractive alike to motor manufacturers and users.

With the development of Fort Dunlop, the largest rubber factory in the kingdom, the company are now in a position to pursue the manufacture of giant pneumatic tires for commercial and other vehicles. The "giants" are of the straight side type. Built on multiple ply cord casing, these tires, 36 by 6 and 40 by 8, are moulded on flat base rims and are easily detached by the removal of one of the rim flanges, without entailing any forcing over the rim by levers. The Dunlop solid giants made in 8 in., 10 in., and 12 in. sections, and in 36 in. and 40 in. diameters, were pointed out as giving great cushioning capacity and prolonged durability, and as being less destructive than the twin. A super cushion tire made its first appearance; a particularly resilient tire for passenger service, which will be welcomed by those who remain sceptical about air-filled tires for heavy loads. Standard solids were on view, one with a non-skid tread, which has been successfully used on fire engines.

FERODO, LIMITED.—Die-pressed brake and clutch linings of pure asbestos was the specialty shown by this well-known firm. This material is produced by a patent process which does away with the physical weakness in asbestos which necessitated the use of wire to sustain the yarn during the process of weaving, and to enable the fabric to withstand brake pressures. It has the hardness numeral of steel, gives a coefficient of friction of ·3 and is unable to score any surface opposed to it.

B. F. GOODRICH COMPANY, LIMITED.—Of Goodrich solid band tires two styles were shown, viz., the ordinary band tire and the "P. B." (protected base). The latter possesses the following unequalled advantages—Better union between rubber and steel, protection against side blows, and greater strength. The rubber tread of both types is famed for unique combination of toughness and resiliency. Industrial truck tires were shown as being tough, resilient and extremely economical. Progressive firms realise how much time and money can be saved by equipping trolleys, factory trucks, and tractors with these smaller band tires. The exhibit provided an opportunity of finding out what amount of saving may be effected by any firm proposing to change over to rubber. The Goodrich artillery wheels are manufactured from thoroughly seasoned timber, and are finished in a superior style. They are in all sizes suitable for pneumatic and solid band tires. Goodrich giant pneumatic tires evoked great interest. These are of the safety tread cord type, sizes 7 in. and 8 in.

GOODYEAR TYRE AND RUBBER COMPANY (GREAT BRITAIN), LIMITED.—The display on this stand was entirely devoted to large size pneumatics. In view of the pioneer work which the Goodyear Company has done in America, and the valuable data which they have collected as a direct result of their experience, it was to be expected that considerable interest would be centred in their display of giant pneumatic tires, an expectation that was fully realised. Prominent amongst the exhibits was the 44 by 10 tire fitted to a wheel of the standard artillery type in order to give an effective idea as to its appearance.

GEORGE HATCH, LIMITED.—A wide selection of machine tools, engineers' hand tools, and engineers' stores formed the main exhibit on this stand. There were also included injector, lubricators, suction hose and a number of fitments and requisites for steam vehicle users, while showcases of milling cutters, lathe chucks, bright steel bolts and nuts, taper pins, steel keys, and bright mild steel in various sections formed a most interesting display. Prominent upon the stand was a complete range of the well-known Duff-Barrett jacks, for which Messrs. Hatch are the London distributors. These attracted considerable attention on account of their light weight, high lifting power, and ease of manipulation.

HAYS, STANDEN AND COMPANY, LIMITED.—The exhibit on this stand comprised brake linings, clutch linings, clutch discs, sheeting, etc., of the Don metallic-asbestos fabric which has given such excellent results under the most severe tests. One of the most successful applications of this lining was shown in the one piece cone clutch facing. It can be supplied to any width or diameter and coned to any desired angle.

HENLEY TYRE AND RUBBER COMPANY, LIMITED.—A comprehensive collection of solid rubber band tires of the well-known high quality supplied by this firm comprised this exhibit. We are informed that American and Continental, as well as the British standard sizes of the Henley tire are held in stock, so that delivery of any of these can be given immediately.

THE HOFFMANN MANUFACTURING COMPANY, LIMITED.—A full range of "Hoffmann" steel balls and rollers and ball and roller bearings was shown on this stand. There was also a short length of shafting fitted with "Hoffmann" patent line shaft bearings and a Leyland double reduction back axle equipped with roller bearings and ball thrust.

THE HOYT METAL COMPANY OF GREAT BRITAIN, LIMITED.—On this stand a variety of die metal castings in "Hoyt" anti-friction metal was shown. Samples of various alloys specially recommended for specific purposes were also on view.

CHAS. MACKINTOSH AND COMPANY, LIMITED.—The display on this stand included samples of solid rubber tires suitable for every type of commercial vehicle now in service, from the smallest delivery van to the heavy steam tractor with wheels up to 5 ft. in diameter. Special interest was taken in the semi-solid or normal air-pressure tire shown. This tire, which is of a most interesting form of construction, has been designed to give resiliency without the disadvantages of pneumatics.

MICHELIN TYRE COMPANY, LIMITED.—A display of "Michelin" pneumatic tires and wheels formed the attraction on this stand, and as a more or less continuous demonstration was given of the simplicity of tire changing when the beaded edge Michelin tire is used in conjunction with the Michelin wheel, interest in the exhibit was maintained throughout the show. The high quality of both wheel and tires is well maintained.

MIDLAND RUBBER COMPANY, LIMITED.—Solid band tires for commercial vehicles in various patterns and in all sizes were shown. It was a complete and comprehensive selection, embracing tires suitable for a light van up to a 10-ton lorry. In the matter of prices the Midland Company have returned to pre-war rates, and the guarantee offered is superior to a mere statistical one. "Midlands mean more mileage" is the assurance, applicable to every tire.

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Prompitude is another feature of the company's policy, home traders being first satisfied before shipping orders. The company's representative explained that quickness of fitting is made a speciality. In London solid tires can be fitted in four hours, and about equal speed is maintained in the principal centres of commerce, where the company have established fully equipped branches.

H. Miller & Company, Limited, of Birmingham.—This firm concentrated on their large range of commercial vehicle lamps, including head, side, and tail patterns. A special feature was the new electric set, which introduces considerable novelty into car electric lighting practice, eliminating a number of the difficulties which have sometimes arisen with this form of lamp, especially as regards breaking of connections. In the Miller Electric lighting set this trouble is entirely done away with by means of a Miller patent. Visitors to Messrs. Miller's stand were able to find a solution to any lighting troubles that they may have experienced.

North British Rubber Company, Limited.—The display on this stand included a wide range of tires for various types of vehicles, prominent amongst them being the "Clincher" solid rubber band tires in different sizes and sections. These ranged from 9 in. electric trolley wheels to those for the heaviest commercial vehicles. There were also special tires designed for fire engines, steam tractors, etc. Samples of rubber goods for engineering and mechanical purposes were also included in the exhibit.

J. and R. Oldfield, Limited.—The well-known "Dependence" vehicle lamp was shown in a wide variety of types. A new model side lamp, known as the "Dependence-de-Luxe" attracted considerable attention, and it is claimed that with this lamp in use head lights for all ordinary purposes are quite unnecessary as a good beam of light is thrown 40 yards ahead. A display of driving mirrors was also included.

The Phosphor Bronze, Limited.—A comprehensive collection of finished bushes, bearings, pump gear, and magneto parts in the company's "Cog Wheel" brand of phosphor bronze and gun-metal made a most interesting exhibit. Samples of "Cog Wheel" brand chill cast phosphor bronze, specially prepared for the motor industry, was also shown.

Ransome and Marles Bearing Company, Limited.—An interesting display of ball and roller bearings made an attractive exhibit. These included ball journal bearings, single, double, and combined radial thrust; roller journal bearing also of the three types, roller bushes, ball thrust bearings, and a variety of bearings for various purposes. A new type of roller bearing was shown, in which the rollers are retained endways in the outer race by means of two spring rings which are sprung into recesses ground in the inside faces of the outer race.

Ripaults, Limited.—"Oleo" sparking plugs and accessories were the specialities shown on this stand. The Oleo plug is made in a variety of types suitable for all classes of vehicles. The Ripault plug tester entirely eliminates the unsatisfactory system of testing with a screwdriver or other tool, or the removal of the plug; the spark is diverted instantaneously from the plug points to the points of the tester. Other exhibits included Ripault's spark tester, sight-feed lubricators, leverless compression tap and specimens of high tension cables.

Shrewsbury, S. T., and Challiner Tyre Company, Limited.—Wheels of various types in steel and wood was a prominent feature of this exhibit. For many years Messrs. Shrewsbury and Challiner have specialised in the manufacture of wheels and have earned a high reputation for the reliability of their output in this direction. An excellent display was also made of solid rubber tires in a wide variety of sizes and sections. Amongst these were included the patent cross-ribbed fire engine tire, large diameter tires for steam tractors, and single and twin tires for all British standard wheels. As evidence of the wearing qualities of the S. and C. tire, samples were shown taken out of service after running 42,000 miles.

Skefko Ball Bearing Company, Limited.—To recite the merits of the various bearings made by the Skefko Company would be tantamount to gilding refined silver. In view of the suggestion at the recent Municipal Tramways Conference that investigations should be made into the question of using roller bearings for tramway cars, it is of interest to mention that the SKF have for some time been engaged in finding a bearing for railwork. As the result of several years' research they have evolved the SKF double row spherical roller bearing, based primarily on the same principles as govern their ball bearing, and its performances in both laboratory tests and under running conditions have fully justified the hopes reposed in it. The defects in the form of roller guidance which have undermined the efficiency of other roller bearing constructions, have been eliminated, and the cage in the SKF roller bearing is merely a separator. The bearing can run without it altogether, and guidance is obtained entirely from the inner race and the construction of the roller itself. The firm have supplied bearings for the trailers used on the London County Council Tramways. SKF ball and roller bearings are used on the leading makes of motor vehicles, including the new Bristol chassis.

S. Smith and Sons (M.A.), Limited.—Everything for the commercial motor user might be the slogan of this Great Portland Street, London, firm. That was the impression conveyed to visitors to their stand. How varied are such requirements will be seen by a perusal of the list of goods shown, and it only needs to be added that the company has built up their reputation as manufacturers by thorough trials of every article that they market. The exhibits comprised combined speedometers and mileage recorders, mileage recorders, revolution indicators, pressure gauges, radiator thermometers, five-jet carburetters, single-jet carburetters, autovacs, electric lighting and starting systems, electric lighting systems, Radamax plug testers, acetylene lighting equipment, commercial oil lamps and accessories, horns, pumps (hand, foot, and engine-driven), non-skids, vulcanising outfits, jacks, M-L magnetos etc.

Leo Swain and Company, of Manchester.—Corporations, tramway companies, and other public services are mostly quite familiar with the word Leosco—the "house name" of Messrs. Leo Swain and Company, Limited, tire manufacturers and motor accessories factors, whose stand attracted considerable attention, owing to the facilities offered for concentrating purchases at one stand. A few only of the outstanding items of the Leosco exhibit may be mentioned. Swain solid rubber band tires had the reputation of being fitted to Karrier, Foden, Pagefield and other wagons by the chassis manufacturers, and used by many experienced transporters throughout the kingdom. Rubber products of all kinds were displayed, including garage hose, rubber matting, gas tubing, horn bulbs, radiator water tubing, vulcanising materials, inside plasters and outside tire gaiters, and also H.F. vulcanisers. The company are also large suppliers of all kinds of mechanical rubber.

The accessories department included such an extensive range of exhibits that for a description our readers should obtain the new Leosco catalogue, which is most comprehensively and handily compiled. All noted makes of sparking plugs were shown, whilst amongst the horns were Leosco bulb horns, Klaxon and other mechanical horns, also the Klaxon electrical models.

Considerable interest was attracted by the Duff-Barrett jacks, capable of lifting anything from a ½ ton to 20 tons. These made an imposing display. The Parsons non-skid chains have always been handled in large quantities by Messrs. Swain, and orders are now being executed for the winter's requirements. Tool kits, springs, nuts, bolts, petrol carriers, petrol fillers, barrel pumps, and so on, added to the variety of one of the best collections of goods ever seen at a motor exhibition.

The United States Rubber Company, Limited.—The "Nobby Cord" pneumatic tire was the specialty shown on this stand. An experience of many years' practice in America with pneumatic tires has evolved a type which the company claim to be specially suited to the requirements of passenger and all classes of goods-carrying vehicles, where rapid transit with absence of excessive vibration and road shocks are desirable. Sections of the tire were shown, from which the form of construction could be seen. The use of piano steel wire as an anchorage for the cords, together with the substantial nature of the tread were indications of the strength and wearing qualities of the tire.

C. A. Vandervell and Company, Limited.—The exhibits from the Warple Way, Acton Vale Works were of exceptional interest to all motor vehicle users. The exhibits included the latest type of electric lamps, constructed of steel and aluminium and reduced to the simplest form possible. The equipments were specially insulated against vibration and road shock. The electric starter just now receiving so much attention from lorry and omnibus builders was shown in its special form for those vehicles, also the new C.A.V. coil ignition system adapted for commercial work, which has received so much favourable comment generally. The new C.A.V. sparking plug made its first public appearance, and as it is manufactured in eleven different types, it secured a large amount of attention. There were numerous requests for information concerning the special exhibit of new type omnibus interior fittings and the lighting batteries constructed entirely in ebonite, with

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special terminal assemblies. It was claimed that 75 per cent. of the vehicles in the show had the C.A.V. equipments.

VICKERS, LIMITED, of Vickers House, Broadway, London, S.W.1, exhibited a large selection of various forgings, stampings, chassis frame pressings and springs for motor vehicles, together with specimen fractures of various tool and other steels. There were also show cases containing sections of tubes and bars, special form cutting tools as castings, and S.R. cutters and files. All these are the products of the River Don Works, Sheffield. A representative range of engineers' small tools, including Vickers' vanadium high-power drills, patent adjustable reamers, broaches, etc., were on view, whilst the Ioco Rubber and Waterproofing Company, of Glasgow (a subsidiary company of Vickers, Limited) displayed samples of motor hood fabrics, leather cloths, radiator tubing, acetylene gas tubing, pyramid and fluted mattings.

WOOD-MILNE, LIMITED.—The collection of solid rubber band tires shown on this stand invited inspection by reason of the known reputation for quality which Wood-Milne manufactures have earned for themselves. All the standard sizes and sections were included, together with a new section designed for the heavier type of vehicle, both steam and petrol. The chief point about these tires is that they have a much broader tread, which has the effect of distributing the weight over a wider area.

ZENITH CARBURETTER COMPANY, LIMITED.—Economy and efficiency are the attributes of the Zenith carburetter, the merits of which have stood the tests of peace and war, the latter including service in every kind of aircraft. The stand had a full range of Zeniths for all types of commercial vehicles, and also examples of special carburetters, with complete sets for well-known lorries. On the 214 vehicles staged in the exhibition, 186 were fitted with Zeniths. The number included the Scammell six-wheeler, which with a load of 13 tons has given a petrol consumption of 6¼ miles per gallon.

LEYLAND RE-CONDITIONED VEHICLES.

As stated in previous issues of the TRAMWAY AND RAILWAY WORLD, the extensive works originally constructed for the Sopwith Aviation Company at Ham, Surrey, have been purchased by Leyland Motors, Limited, and specially organised for handling the large number of Leyland vehicles returning from British military operations in all parts of the world. Recently a representative of this journal was given an opportunity of inspecting the work in progress for reconditioning these machines, and was greatly interested in the various processes through which each unit passed before arriving at its destination—the scrap heap or the stores. A notable feature of the system under which the work is carried out is the manner in which the actual cost of reconditioning each vehicle is obtained, although by reason of their interchangeability it is quite unnecessary for any part to be returned to the same chassis. Immediately the machine is taken in hand it is given a works number, and all operations to each and every part is charged to that number. Owing to the dirty and neglected condition of the machines on their arrival, it has been found necessary to instal a cleaning plant of some pretension where by means of steam jets and paraffin the actual condition of the chassis and its component parts can be discovered by the viewer, in order that their fate may be decided. Before taking its place in the shop where the rebuilding is carried out, each chassis is stripped to the bare frame, with the exception of the back axle, which on account of its weight has been found more convenient to handle in position and upon its wheels. Arriving in the erecting shop, the back axle is then taken down and minutely examined. All the gears are tested to gauge and template, as indeed is every part of the machine, so that when the reconditioned chassis is passed out to the paint shop every wearing part is in perfect order and fit to maintain the reputation the Leyland machines have established. Many of the actual processes witnessed were highly interesting, and gave evidence of the extreme care taken to ensure that degree of accuracy in fitting, alignment, etc., which alone makes for efficiency.

RECONSTRUCTION WORK IN BELGIUM.—The Commercial Motor Users' Association have made arrangements with the Department of Overseas Trade whereby motor haulage contractors who desire to send their motor lorries to the continent for work in connection with reconstruction may do so without having to deposit cash in respect of the 70 per cent. *ad valorem* custom duty. The Belgian Customs authorities have agreed to accept a written guarantee from the association in respect of such deposit.

THE MOTOR OMNIBUS IN URBAN TRANSPORTATION.

A SUMMARY OF A PAPER BY MR. G. J. SHAVE AND MR. F. C. PICK.

The Motor Omnibus in Urban Transportation is the title of a paper prepared by Mr. George J. Shave, manager of maintenance of the London General Omnibus Company, and Mr. Frank C. Pick, commercial manager of the same company, which was read in their absence at the annual conference of the American Electric Railway Association, at Atlantic City, New Jersey, on October 14. The paper contains many facts and opinions that are of great interest, and we regret that we can here give only a summary of the thesis.

The mileage of streets and roads in Greater London occupied by electric tramways is 348. The mileage occupied by motor omnibuses is 577, of which 222 miles are over the tracks of the tramways. The problem of the relation between the two is thus a peculiar problem in London. London is distinguished in being the pioneer of the motor omnibus in public service. Unlike London, the motor omnibus in America finds a large portion of its prospective field occupied by a well organised and established rival, the street railway.

COMPARISONS—SPEED.

In any discussion of the relative merits and capacities of the street railway and the motor omnibus route, it is important to compare the vehicles employed. The principal factors in such a comparison are four—speed of operation, road occupation, convenience and flexibility of operation, and passenger accommodation. The authorised maximum omnibus speed in London of 12 miles per hour is generally agreed to be too low, and there could be little opposition to its increase to 18 miles per hour. It is hoped soon to effect this amendment. The average speed in actual operation under urban conditions is about 10 miles per hour. This allows for three or four stops to the mile. In London the tramways have maximum authorised speeds ranging from 6 to 16 miles per hour, according to varying conditions, the normal speed being 12 miles per hour. Again this is thought to be too low, and it is expected that it will be raised to a figure comparable with that for the omnibus given above. The actual average speed of operation under urban conditions is about 9 miles per hour, with about five stops to the mile. The too great frequency of the stops is a determining cause in the relatively less efficient speed of the tramcar compared with the omnibus. There will, however, always be a slight gain of speed in favour of the omnibus, because of its quicker stopping and starting.

In Manhattan, New York, the average working speed of street cars is 7 miles per hour (while the maximum is only 9), and of omnibuses in Fifth Avenue, 8·5 miles per hour. In Broadway, New York, the stops have mounted to nearly 15 to the mile. Stops are the real determinant of speed, and the larger the vehicle the longer the stop, because the greater the load.

Having regard to the fact that the street railway usually occupies the centre of the road allotted to fast-moving traffic, there is every reason why it should operate at a relatively high speed, because it will then be less obstructive to other fast-moving traffic in that position. This and the danger to passengers boarding and alighting in the centre of the road would seem to dictate a policy of few and well-regulated stops as the right one.

Road occupation is a function of the speed of operation, and the size of the vehicle. There has always been bitter argument as to whether a motor omnibus or a street car occupies the roadway to the greater extent and so contributes in the greater degree to cause congestion. For London the following revised table of co-efficients of obstruction has been arrived at—

Passenger Vehicles.		Trade Vehicles.	
Electric tramcar	9	One horse, fast	3
Omnibus, horse	5	,, slow	7
,, motor	4	Two horse, fast	4
Cabs, horse	2	,, slow	10
,, motor	1	Light motor, fast	1
Carriages, horse	2	Heavy motor, fast	3
,, motor	1	,, ,, slow ...	5
		Barrows	4
		Bicycles	½

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With the increase in the seating capacity of the motor omnibus first to 46 and then to 57, which is now taking place in London, there can really be no question at all left that as a cause of congestion the motor omnibus is a smaller contributor than a tramcar.

Convenience and Flexibility.

Under this heading the authors pointed out how the omnibus can accommodate itself to other traffic, and can set down and take up passengers at the kerb, thus increasing safety. Again, there is no limit to the extent to which passenger traffic can be dispersed by the use of omnibuses. Services can be taken much more nearly to the actual points at which passengers arise in the residential districts or to which they proceed in the commercial districts, and *vice versa*. The services in an arterial road may branch out into secondary roads on either side.

This reminds us of the striking difference between the lay-out of the routes of street cars in an American city and the lay-out of the omnibus routes in London. In an American city the routes are few and direct to some central point or diametrically across some central point. Passengers not desiring to take rides on a direct route are given transfer tickets. In London routes are many and are interlaced, so that in a given main radial there may be services to five or six different destinations by different routes. This wide choice removes the need for any transfer ticket. The tramways in London copy as far as possible the omnibus routes in their complexity, but the delays at junction points of tramway tracks are a deterrent obstacle to the practice.

Against the merits of dispersal and flexibility is to be set the cost of maintaining many more roads suitable for heavy motor car traffic.

Passenger Accommodation.

This factor somewhat adjusts the balance in favour of the street car. In London up to 1919 the standard omnibus seated only 34 passengers, while the standard tramcar seated 78. With the rise in the costs of operation, the smaller capacity of the omnibus restricted earnings and became uneconomical. Prior to the war, the earning capacity per mile run of both vehicles had been approximately equal. With the war and the growth of traffic occasioned by it, the tramcar drew ahead of the omnibus, and the problem of enlarging the latter became acute. Early in 1920 a 46-seat omnibus was built and proved successful. The comparison of the old and new vehicles, with the regulations establishing the standard approved by the police, is outlined as follows—

Item.	Police Regulations.	Pre-War or B Type	Post-War or K Type.
Length	Not to exceed 23 ft.	22 ft. 6½ in.	22 ft. 7⅞ in.
Height	12 ft. 6 in.	12 ft. 7 in.	12 ft. 2 in.
Width	Not to exceed 7 ft. 2 in.	6 ft. 11½ in.	7 ft. 1½ in.
Wheelbase ...	Not to exceed 14 ft. 6 in.	12 ft. 10⅜ in.	14 ft. 2¼ in.
Overhang over back axle ...	7 ft. 6 in.	7 ft. 7⅛ in.	6 ft. 7¾ in.
Weight* unladen	Not to exceed 3 tons 10 cwts.	3 tons 12 cwts.	3 tons 9 cwts.
Weight laden ...	Not to exceed 6 tons	6 tons	6 tons 13 cwts.

* The police have permitted variations in the weights.

With a lengthened wheel base and improved springing, the additional weight means less and not more road shock. The general safety of the vehicle has been improved by lowering the floor from 35 in. above the road to only 29 in. Experience with the operation of this omnibus revealed the possibility of something still more commodious, and a 57-seat omnibus has been built experimentally. It has proved successful and 250 of the type are now under manufacture.

Reverting to the other side of the account, the street car scores by its ability to draw a trailer. There is talk of an omnibus trailer, but up to the present this is idle. The street car of the usual type seats 50 to 60 passengers and easily accommodates as many more standing. The omnibus seats 42 to 44, but accommodates at the most 8 or 10 others. The handicap of the omnibus therefore persists under American conditions and there can be no question that accommodation afforded must tend to become the crucial test of efficiency in street transportation.

Cost of Operation.

The cost per car-mile of operating an electric street railway in London is slightly more than the cost of an omnibus-mile. The difference is negligible. The principal chance of divergence must rest in the cost of fuel. The danger to the omnibus industry seems to centre in the fuel problem. Before the crisis comes benzol or power alcohol may have achieved commercial success. Therefore there is no reason to fear that there will ever be a marked divergence in the costs of the two methods of transport.

On the other hand, the capital cost of tramways far exceeds the capital cost of providing motor omnibus routes (the ratio is over three to one) and unless this capital cost can be spread over a dense service it becomes a burdensome charge per car-mile, and definitely places the tramcar in a worse position. It is estimated that, to enable competition by these two instruments of transport to be conducted on approximately equal terms as to cost per car-mile, the street car service must amount to not less than an average of 25 in the hour throughout the day in each direction.

Passenger Movement.

There is a further question. What is the traffic problem to be tackled? A brief examination may be given under two heads, street capacity and passenger density. One reason why London has remained a motor omnibus city is the narrowness of its main streets and the irregularity of its planning. Under favourable conditions the maximum number of cars passing in one direction across a point in a continuous running track is only about 65 in the hour with trailers attached, or 80 without trailers. This falls short of the results obtained in America, but there the wideness of the streets tends to insure continuous free passage to the street cars.

The Strand, in London, which is in places only 32 ft. wide in the carriage way, carries omnibus services amounting to 170 vehicles in the hour in each direction. Oxford Street, which is 52 ft. wide, has 199 omnibuses in the hour in each direction. When the other vehicular traffic is considered, these results are emphatic testimony to the flexibility of the omnibus and its adaptability to streets of such a character. The maximum omnibus movement in London is in Whitehall, which is very wide, and amounts to 216 per hour in each direction.

As to passenger density, whatever instrument of transport is chosen it must be capable of dealing with the peak load. Observation in London shows one curious feature. The omnibus is more successful than the tramcar in attracting passengers during the slack hours. It creates a traffic which cannot be secured by a tramcar because it enjoys a greater esteem and higher prestige. In New York the same feature is observed.

Calculating the maximum possible carrying capacity of omnibuses or tramcars or of trains on a railway, and the minimum possible load which would be economical, we can decide as follows—

Very light passenger traffic (under 500,000 passengers per mile of route per annum) can only be economically carried by omnibus.

Light passenger traffic (from 500,000 up to 1,000,000 per mile of route per annum) is best carried by omnibus, but can also be economically carried by street car.

Medium passenger traffic (from 1,000,000 up to 4,000,000 per mile of route per annum) can be carried by omnibus, street car, or railway train.

Heavy passenger traffic (from 4,000,000 up to 6,000,000 per mile of route per annum) can only be carried by street car or railway train.

Very heavy passenger traffic (over 6,000,000 per mile of route per annum) can only be carried by railway train.

Another method of analysis is interesting. For convergent traffic between homes and workplaces tramways or railways are most suitable. For incidental short distance traffic omnibuses or tramcars are most suitable. For dispersed traffic, moving transversely or eccentrically, and usually light, omnibuses or railways are most suitable. It is estimated that in London 40 per cent. of the total movement is convergent, 40 per cent. incidental, and 20 per cent. dispersed.

Correct Solution Wanted.

In considering the question of when a motor omnibus route is the correct solution of a street traffic problem, the first point is whether there is a street railway, and if so whether it is capable of dealing satisfactorily with the problem, and what new service can the omnibus route afford. When the street car service is unable to deal with all the traffic, it is right to supplement it by an omnibus service. The slack hours can usually be covered by the omnibuses, leaving to the street cars the duty of coming in to relieve the heavy

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MOTOR TRAFFIC

stress of the rush hours. The street car is a peak-load vehicle. But then there is the capital sunk in the tramway, power plant, etc., so that the question of efficiency must be qualified by financial considerations.

Where the street car service pursues a direct and single route, omnibus routes passing over the street railway tracks and diverging laterally to suit requirements are justified. Where an omnibus route proceeds over a street railway, and advances beyond it, it is affording a new facility which justifies it. The overlap should, however, not exceed such reasonable length of between one and two miles as will give a continuous ride to short-distance passengers crossing over what would otherwise be the point of break in service.

There is not an instance in London where an omnibus route immediately parallels a tramway that is not justified under one or other of the above propositions, nor is there a single instance where the tramcar and the omnibus perform exactly the same service. Where a tramway route and an omnibus route work in parallel over a considerable distance, it may be desirable that the service each provides should be differentiated. For example, by eliminating stops on the tramway, the effective speed of the service may be increased and it becomes non-stop or semi-express, while the omnibus service steps into its place to deal with the short-distance casual traffic. No such step in co-ordination has been attempted in London, but it would seem worth trial.

Competition, as competition merely, in transport service cannot be justified where there is public regulation or control. The best service can be given under such circumstances by co-operation. In American cities with their elaborate transport commissions, therefore, there is always an independent body able to weigh up the merits and capacities of the various instruments of transport and give a judicial and equitable decision. There can be no excuse for what is known as jitney competition. In London, where there is no such control organisation in existence, and where the municipal authorities own part and private companies other part of the transport facilities, there is necessarily room for conflict, but even then commercial considerations always tend to secure adjustments of view and efforts at co-ordination. The aim that is to be sought is a franchise with its essential concomitant public control, with co-ordination of all transport services.

Where Omnibuses should be Used.

Taking now the case where there is no tramway, for traffic up to an average throughout the day of 1,000 in the hour, which will most likely correspond to a maximum movement of 3,000 in the rush hour in one direction, the motor omnibus is the best practical solution, and between 3,000 and 5,000 both tramcar and omnibus are capable, with a preference in favour of the omnibus, and between 5,000 and 8,500 both are still capable, but now with a preference in favour of the tramcar. Over 8,500 up to 12,000 the tramcar is capable, after which a new means of transport must be introduced.

This means that for traffic on lightly or moderately loaded roads omnibuses should be used. This is the case on all cross-country routes, on cross-connecting roads, on extensions into the outskirts of cities. Main radial city routes are street railway routes, and some of these call for both street railway and omnibus routes.

Thus the problem looks simple, but, alas, the traffic problem is never stationary. Traffics come into being and disappear; they shift from place to place. Different quarters of a city have their different traffic idiosyncracies. Here is the great advantage of the omnibus route; it can follow the traffic. It can test changes in flow of traffic. It can seek out and create traffics. It need never be left desolate when its traffic has disappeared.

More important than the shift of traffic is its constant increase in total volume. There is no fixed measure by which to decide in favour of street car or omnibus. And here a new instrument of transport forces itself upon the attention. There is a limit to the capacity of the street car. Over 12,000 passengers in the hour in one direction means the breakdown of the service, after making liberal allowance all the while for strap-hangers. Then the underground or elevated railway, the specialised street with the specialised transport must appear. Once again there is a minimum limit These railways are expensive to construct and probably a density of less on the average than 2,500 passengers per hour each way at any point would be uneconomical, but the maximum is advanced to much higher figures. Ten-car trains, each accommodating 90 passengers seated and as many more standing, running on a close headway giving 36 to the hour in one direction, multiply up to a grand total movement of 64,800 passengers.

All a reasonable man can do is to look ahead, and estimate as he is best able what the traffic requirements will be and provide accordingly. But he will use the omnibus whenever he can, because the risk of loss is much less on account of its transferability. He will not build a street railway when he knows that soon he will want an elevated or underground railway, for with an underground or elevated railway to handle the peak traffic and the long-distance traffic he will find the omnibus to be a sufficient auxiliary in the street above to deal with the casual short-distance traffic. This is the situation in large sections of London, and it is eminently satisfactory. This explains why London cannot ever be a tramway city. The tram has gone by, the phase is past. It may be a lesson for America, but who are we to say that ?

OMNIBUS SERVICES.

Salford.—The Tramways Committee have recommended the purchase of a Leyland single-deck omnibus at a cost of £2,062.

Grimsby.—In their new Parliamentary Bill the Corporation are seeking powers to run omnibuses within and beyond the borough.

Wolverhampton.—The Corporation are applying to the Ministry of Transport for permission to increase the omnibus fares up to 2d. per mile.

South Shields.—The Tramways Committee have decided to seek further powers to run omnibuses outside the borough boundaries on routes as may be agreed upon with the local authorities.

Rotherham.—The Tramways Committee have requested the Parliamentary Committee to include in the next Corporation Bill a clause for extending the motor omnibus services beyond existing tramway and omnibus routes.

Bournemouth.—Upon an application from Mr. Graham, general manager of the Hants and Dorset Motor Services, Limited, the Bournemouth Corporation Licensing Committee have promised to favourably consider the granting of ten additional licences on an inspection of the vehicles.

Hull.—At Hull Corporation Tramways Committee the Town Clerk reported that it would be unnecessary to promote legislation for the purpose of obtaining powers to run omnibuses, but that powers could be obtained by Provisional Order and that it would be necessary to define the routes. The committee decided upon various routes, and agreed to apply for a Provisional Order.

Dorchester and District.—The Town Clerk of Dorchester has notified local authorities concerned that his Council have been in communication with the Hants and Dorset Motor Services, Limited, with a view to a regular service between Bournemouth, Dorchester, and Weymouth, and had resolved to give assistance. He therefore asks the authorities concerned to grant equal facilities to persons operating a similar service between Dorchester and Bournemouth.

Belfast.—In a report presented to the City Council on November 1 by the Tramways Committee, it was recommended that six motor omnibuses should be purchased from the London General Omnibus Company at a cost of about £500 each, to run during rush hours between Hamilton Road and Connswater and Dee Street, so as to give accommodation to shipyard workers and women. The recommendation was agreed to. The service is to be instituted under the powers possessed by the Corporation to run omnibus services between tramway termini. It was agreed to defer for a year a proposal to apply for powers to run omnibuses to Bangor, Lisburn, Carrickfergus, Newtownards, and Comber, and to extend the tramways beyond the city boundary.

Birkenhead.—In his 1919-20 report, Mr. C. Clarke, manager of the Corporation Tramways and Motors Department, states that following on the powers sanctioned by Parliament in 1914, an order was placed with Leyland Motors, Limited, in February, 1919, for ten omnibuses. Four were delivered in July, 1919, and a service was instituted between Rock Ferry and Park Station and subsequently extended to Moreton. The financial result was very satisfactory as a commencement, especially in view of the fact that it is largely a "fine weather route," and that the period covered by the return is mainly the winter months. Further omnibuses were delivered early this year, and on completion of the order in June a route from Charing Cross to Upton was opened. The expenditure was £5,892, and £2,118, or 4·920d. per omnibus mile, balance was carried to net revenue account.

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MOTOR VEHICLES FOR MUNICIPALITIES.

DUDLEY WATCH COMMITTEE have ordered a Leyland fire engine and appliances.

LETCHWORTH URBAN COUNCIL propose to purchase a 60-H.P. motor fire engine.

MARYLEBONE BOROUGH COUNCIL have taken delivery of two Lacre road sweepers.

SUTTON COLDFIELD COUNCIL are borrowing £1,700 for the purchase of a motor fire engine.

SALFORD WATCH COMMITTEE propose to obtain a second-hand Napier chassis for £375.

BIRMINGHAM HOUSING COMMITTEE have recommended the purchase of a motor car.

OSSETT COUNCIL have empowered a sub-committee to purchase a lorry for the gas department.

PRESTON CORPORATION have accepted a tender for supplying a 5-ton steam wagon for £1,410.

NEWBURN COUNCIL have obtained a loan of £2,100 in connection with the purchase of a motor fire engine.

BRIDGWATER RURAL COUNCIL have obtained permission to raise a loan of £3,160 for the purchase of haulage plant.

WILLESDEN COUNCIL'S motor ambulance, since the inception of the service six years ago, has traversed 316,605 miles.

ST. PANCRAS BOROUGH COUNCIL propose to instal a motor generator set at a cost of £350 for the charging of electric vans.

YORK HEALTH COMMITTEE have authorised a sub-committee to consider the question of the purchase of a motor ambulance.

WOLVERHAMPTON COUNCIL are purchasing a tipping body for the purpose of converting an old Albion omnibus chassis into a tipping wagon.

LEEDS GAS COMMITTEE have accepted the tender of Hugh Wood and Company, Limited, for a Jeffrey wagon loader for New Wortley works, at the price of £690.

BRADFORD WORKS COMMITTEE have authorised their chairman and the city engineer to purchase such additional motor vehicles as may be needed by the department.

SHEFFIELD CORPORATION have received permission to raise a loan of £62,000 for the purchase of electric tipping wagons, the period allowed for repayment being seven years.

GLASGOW CLEANSING COMMITTEE have recommended acceptance of the offer by the Scottish Electric Vehicle Company, Limited, to supply the chassis for four electric tipping wagons.

LIVERPOOL GENERAL PUR OSES COMMITTEE have recommended the purchase from Messrs. Walker Brothers (Wigan), Limited, of ten short base motor tipping wagons at a cost not exceeding £1,450 each.

SOUTHEND HIGHWAYS COMMITTEE have recommended the purchase of a new battery for an electric vehicle from the Chloride Electrical Storage Company, Limited, at £198, the battery to have a 226-ampere capacity.

ILFORD WORKS COMMITTEE have recommended the purchase of a 3½-ton Orwell electric lorry at £1,690, from Messrs. Ransomes, Sims and Jeffries, who stated that the vehicle could be delivered immediately. Delivery was taken some weeks ago of six 2-ton electric wagons from the same firm.

ESSEX COUNTY COUNCIL have authorised the following purchases—Two 5-ton tractors or steam wagons, four trailers, one cycle and side car, at a total cost of £3,310; two 5-ton Marshall trailers at £340; and one Foden steam wagon. The Council have realised £200 from the sale by auction of an old Clayton steam wagon.

WESTMINSTER CITY COUNCIL invited quotations for the supply of ten petrol motors for the cleansing department, and had twenty-four tenders submitted. The Works Committee declare that, anxious as they are to get more motors so as to avoid horse hire, they find the tenders extremely high. Further, they are informed that an excellent type of lorry can be purchased abroad at much less cost than present English market prices, even after making an allowance for carriage to this country. Understanding that there is still a large stock of motor vehicles at the Slough depot, a deputation went there and saw three suitable Thornycroft chassis. The committee recommended their purchase. By this means it is computed that the slight repairs and provision of bodies will enable the Council to get each complete lorry at £683.

MOTOR TRAFFIC NOTES.

GLASGOW TO ENCOURAGE ELECTRIC VEHICLES.—Glasgow Corporation have asked a sub-committee to consider as to the desirability of promoting the use of electricity for battery propelled vehicles.

VETO ON HEAVY VEHICLES.—In a bill to be promoted in Parliament next session Grimsby Corporation ask for powers to make regulations as to street traffic, and to restrict the use of certain streets to heavy vehicles.

EFFE T OF MOTOR TRAFFIC ON STREET CLEANSING.—Kensington Borough Council have been informed by their surveyor that Sunday scavenging is not now necessary owing to the fact that there is so little horsed traffic on that day.

LORRIES FROM GERMANY.—It is reported by a well-known city firm that they have received an offer of three and four ton motor lorries from manufacturers at Charlottenburg at £600 each, and that a consignment has been obtained by a British firm to re-sell.

PETROL PUMPS ON KERBS.—Swansea Highways Committee have received an application for sanction to the erection of petrol pumps at the edge of the footways at premises in Dillwyn Street and Fisher Street. The committee have recommended that the applications be acceded to.

THE ECONOMY OF TRAILERS.—The borough surveyor of Southend has reported as to an economy and increase of efficiency which might be effected by the purchase of additional trailers for use in connection with the existing motor wagons. The Highways Committee have asked him to obtain information as to suitable trailers.

LONDON OMNIBUS STOP PROPOSAL.—The Commissioner of Police is considering, in conjunction with the Technical Committee of the Advisory Committee on London Traffic, a suggestion that a regulation should be made insisting that omnibus stopping places should be at least 30 yards in the rear of tramway stopping places. The stops have been so arranged by the committee all over London during the present year.

LANCASHIRE ROAD IMPROVEMENT SCHEMES.—With a view to learning what Government grant would be made, Lancashire County Council Roads Committee have forwarded to the Ministry of Health a plan for improving the long and tortuous road by which the holiday traffic is taken to and from Blackpool via Garstang. If the work is undertaken it will be a long and costly job. The committee are considernig a scheme for a by-pass road round Ormskirk, and, at the request of Liverpool Tramways Committee, they are also going into the question of widening the road to Prescot.

ALTERING STOPS TO PREVENT SPLASHING.—Northampton Watch Committee have on several occasions during the past few years requested the Wellingborough Omnibus Company to take steps to prevent mud splashing. The company's reply was that so far as the manager could ascertain no successful appliance has been invented. The committee have now altered the positions of two stops and abolished Abingdon Square as a stopping place until satisfactory arrangements have been made to obviate splashing. If they have not already done so, the company might suggest to the committee that uneven road surface is the cause of splashing.

RACING BY COMPETITIVE OMNIBUSES.—At the quarterly meeting of the Urban Councils Association a letter was read from Ellesmere Port Council drawing attention to the desirability of powers being conferred on local authorities (1) to prevent racing between competitive omnibuses, and (2) to enable them to take into consideration when granting licences the question of time tables. The association came to the conclusion that the question of racing was one which should be dealt with by the local police, and instructed the secretary to represent to the Ministry of Transport the desirability of legislation to permit of a reasonable control by the licensing authorities over the time tables to be observed by applicants for licences.

RAILLESS TROLLEY SERVICE.—The half-yearly balance sheet of Rotherham Corporation Tramways Committee records a surplus of £440 on the railless vehicles for the six months ended September 30, compared with a loss of £1,302 for the corresponding period in 1919. There was a surplus of £501 on the petrol omnibuses, as against a loss of £400 for the corresponding half-year. The manager reports that it is necessary, for renewals, to spend £1,000 per annum on the railless cars and £1,500 per annum on the petrol vehicles. The tramways committee have asked the Parliamentary Committee to include in the next Corporation Bill clauses for powers to increase the weight of the railless trolley cars, and to increase fares to 2d. per mile. When two new chassis now on order are delivered the service to Maltby is to be increased.

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THE Tramway & Railway World
WITH MOTOR TRAFFIC SECTION

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MELBOURNE AND METROPOLITAN TRAMWAYS BOARD.

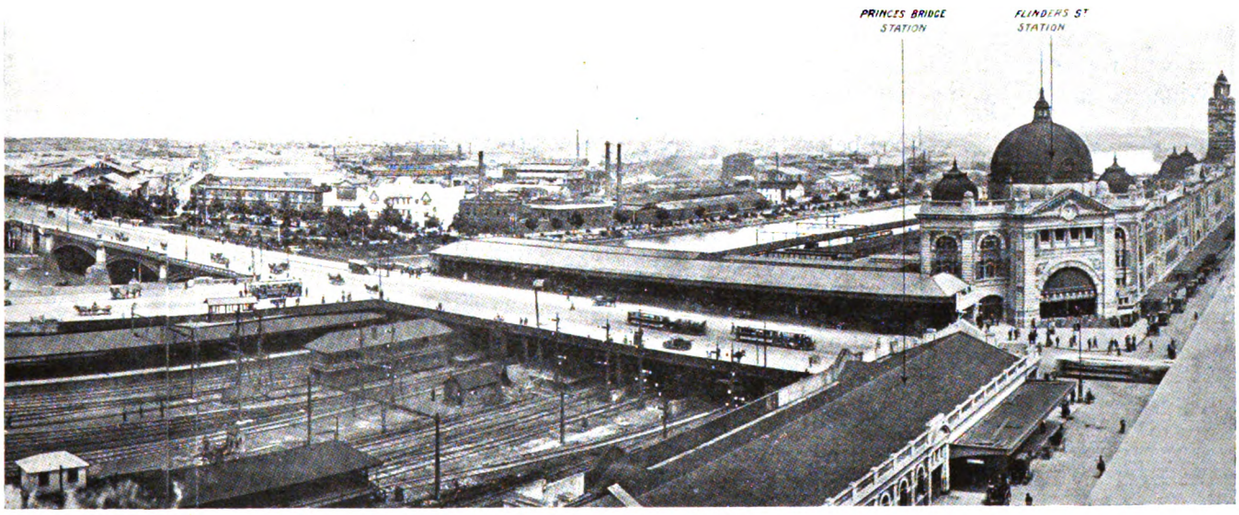
ORGANISATION AND WORK OF THE NEW AUTHORITY.

The Melbourne and Metropolitan Tramways Board, which was set up by an Act that received the Royal Assent on January 17, 1919, has presented its first report to the Minister of Public Works, Victoria. This report covers the period from November 1, 1919, to June 30, 1920, and indicates clearly the important part which the new organisation is destined to play in the development of transport in Melbourne and the surrounding district. By virtue of the Act the late Tramway Board ceased to exist on November 1, 1919, and all its property, powers, and liabilities were then transferred to the new Board. In February, 1920, the Prahran and Malvern Tramways Trust, the Hawthorn Tramways Trust, the Melbourne, Brunswick and Coburg Tramways Trust, the Fitzroy, Northcote and Preston Tramways Trust, and the Footscray Tramways Trust ceased to exist and their powers and liabilities devolved upon the new Board. The Fitzroy, Northcote and Preston tramways have been completed by the Board and were opened for traffic on May 1, 1920. The Footscray tramways, with the exception of a line along Hyde Street, have been completed. The Board expresses the opinion that a large additional outlay will have to be incurred, and considerable delay will elapse before power can be obtained to put the tramways into operation.

The various tramways and their administration have been grouped as follows—

(*a*) Metropolitan cable tramways, Northcote cable tramway (known as the "Cable System")

(*b*) Prahran and Malvern, and Hawthorn electric tramways (known as the "Eastern System").



Cable Cars Passing Princes Bridge and Flinders Street Stations, Melbourne.

(*c*) Melbourne, Brunswick and Coburg, and Fitzroy, Northcote and Preston electric tramways ("Northern System").

(*d*) Footscray electric tramways.

The capital cost of the works and undertakings vested in the Board aggregated £3,774,564 allocated as follows—

Metropolitan Cable Tramways (Melbourne)	£2,170,933
Prahran and Malvern Tramways Trust	851,998
Hawthorn Tramway Trust...	299,896
Melbourne, Brunswick and Coburg Tramways Trust ...	187,009
Fitzroy, Northcote and Preston Tramways Trust ...	129,809
Footscray Tramway Trust	88,747
Northcote Cable Tramway	46,169

Under the Act it is provided that the Board shall pay to the consolidated revenue of the State of Victoria

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in each year a sum equal to the amount disbursed by the State treasurer in connection with the Queen's Memorial Infectious Diseases Hospital, the Metropolitan Fire Brigades Board, and to the municipalities pursuant to the Licensing Act, 1916. These payments vary from year to year, and at present amount approximately to £78,000 per annum.

The Act requires the establishment of a "renewals reserve fund" and a "general reserve fund," and to the reserve funds must be carried such sums as taken together shall not be less than £4 and not more than £6 per cent. of the capital cost of the undertaking. The Board is also authorised to institute a "maintenance reserve" and "guarantee fidelity funds." For the period ended June 30, 1920, there have been transferred to the credit of the respective funds the following sums—renewals reserve fund, £150,000; general reserve fund, £60,000; guarantee fidelity fund, £3,000; total, £213,000.

APPEALS BOARD.

Pursuant to the Act, an "Appeals Board" has been created, consisting of one representative appointed by the Board, one elected by the employees, and an independent chairman appointed by the Governor in Council. This Board hears appeals from employees against "dismissals, fines, deductions from wages, reduction in rank, grade or pay, or other punishments inflicted" by the Tramways Board, and also "appeals on the ground of promotions unreasonably withheld."

Two agreements have been made between the Tramways Board and the Australian Tramway Employees' Association, dated April 23, 1920. One of these provides that on January 1 and July 1 in each year, until May 22, 1922, the rates of wages shall be automatically increased or decreased by a sum per day which will represent the increased or decreased cost of living as shown by the figures compiled by the Commonwealth Statistician, with a proviso that the rates of pay are not to be reduced below the rates fixed in the agreements made in the year 1919.

EMPLOYEES' MUTUAL BENEFIT SOCIETY.

For many years the Melbourne Tramway and Omnibus Company and the late Tramway Board contributed pound for pound to the funds raised by the Cable Tramway Employees' Mutual Benefit Society, which provides medical advice, sick pay and funeral allowances to members and their families. The new Board's contribution at present amounts to about £2,500 per aunum. The admission to the society of the employees of the various electric tramways taken over by the Board will largely increase the latter's contribution.

INCREASED TRAFFIC.

Notwithstanding the heavy losses occasioned by industrial troubles, there has been a general increase of expenditure by the public in tramway travel which is reflected in the gross receipts. Reference to the statistics given in the report show that the receipts from passenger fares earned upon the cable and electric tramways, for the year ended June 30, 1920, amounted to £1,471,940, as compared with a sum of £1,294,916 received during the previous year, an increase of £177,024. This increase has, however, been absorbed by the greatly enhanced cost of wages and maintenance materials. In this connection it should be noted that, as far as can be ascertained, the fares upon practically every tramway system in Australia have been repeatedly raised. This Board has, however, made no increase in fares. It has, on the contrary, reduced fares by putting into operation penny sections at the suburban termini and has also abolished the surcharge of one penny upon all Sunday and public holiday journeys on the Prahran and Malvern electric tramways.

PROPOSED NEW CUSTOMS TARIFF.

The proposed new Customs tariff will greatly increase expenditure, both as regards the maintenance of existing, and the construction of new tramways. By way of example two items may be mentioned; viz., the proposed duty upon cable tramway ropes and upon tramway rails. Cable tramway ropes are not manufactured in Australia, and practically the whole of the Board's supplies are obtained from Great Britain. Ropes of the special manufacture required for the cable tramways are not used in connection with other industries, and are at present imported duty free. From January 1, 1921, however, a duty of 30 per cent. is proposed upon ropes imported from England.

The proposed duty upon tramway rails will also very seriously add to the cost of new electric tramways. Grooved girder tramway rails are not at present manufactured in the Commonwealth, and even if their manufacture were decided upon, a considerable time must elapse before rails could be delivered. It is therefore probable that for the time being the Board will need to import rails manufactured outside of Australia. The present Customs duty is 17s. 6d. per ton upon rails imported from Great Britain, and 25s. per ton for those produced in other countries. It is proposed that from January 1, 1921, the duty shall be 35s. and from 60s. to 75s. respectively. Latest advices are to the effect that British manufacturers are not at present prepared to receive orders for rails. If the new duty be enacted, the cost of rails will probably be about four times that existing before the war.

In view of the stringency of the money market and the prevailing high rate of interest, the Board will require to adopt a conservative policy in the construction of new tramways, and the abnormally high cost of construction will curtail the length of new track which would otherwise be justified in the near future.

DISTRIBUTION OF SURPLUS REVENUE.

Section 89 of the Act provides that the surplus revenue of the Board's undertaking shall in any year, after carrying to the credit of the following year a sum not exceeding £10,000, be distributed amongst the 28 municipalities included in the Tramway Metropolis Board. The Act further directs that the sums thus to be received by the municipalities shall be applied towards such purposes as the Governor in Council shall approve.

After considering various possible methods of distribution, the Board determined to adopt the following scheme, which, in its opinion, gives effect to the intention of the Legislature. The distributable profits have been divided into three equal parts and allocated under the heads of "Population," "Valuation," and "Car Mileage" respectively. The proportion due to each municipality under these respective heads was then ascertained. The total represents the respective share of each municipality.

ADMINISTRATION.

As far as possible the administration of the combined system is being centralised and the chief administrative officers are now located at the head office in Melbourne. All purely local matters directly connected with traffic operations, including complaints, statistics, and the checking and banking of the daily revenue, are dealt with at the various local offices.

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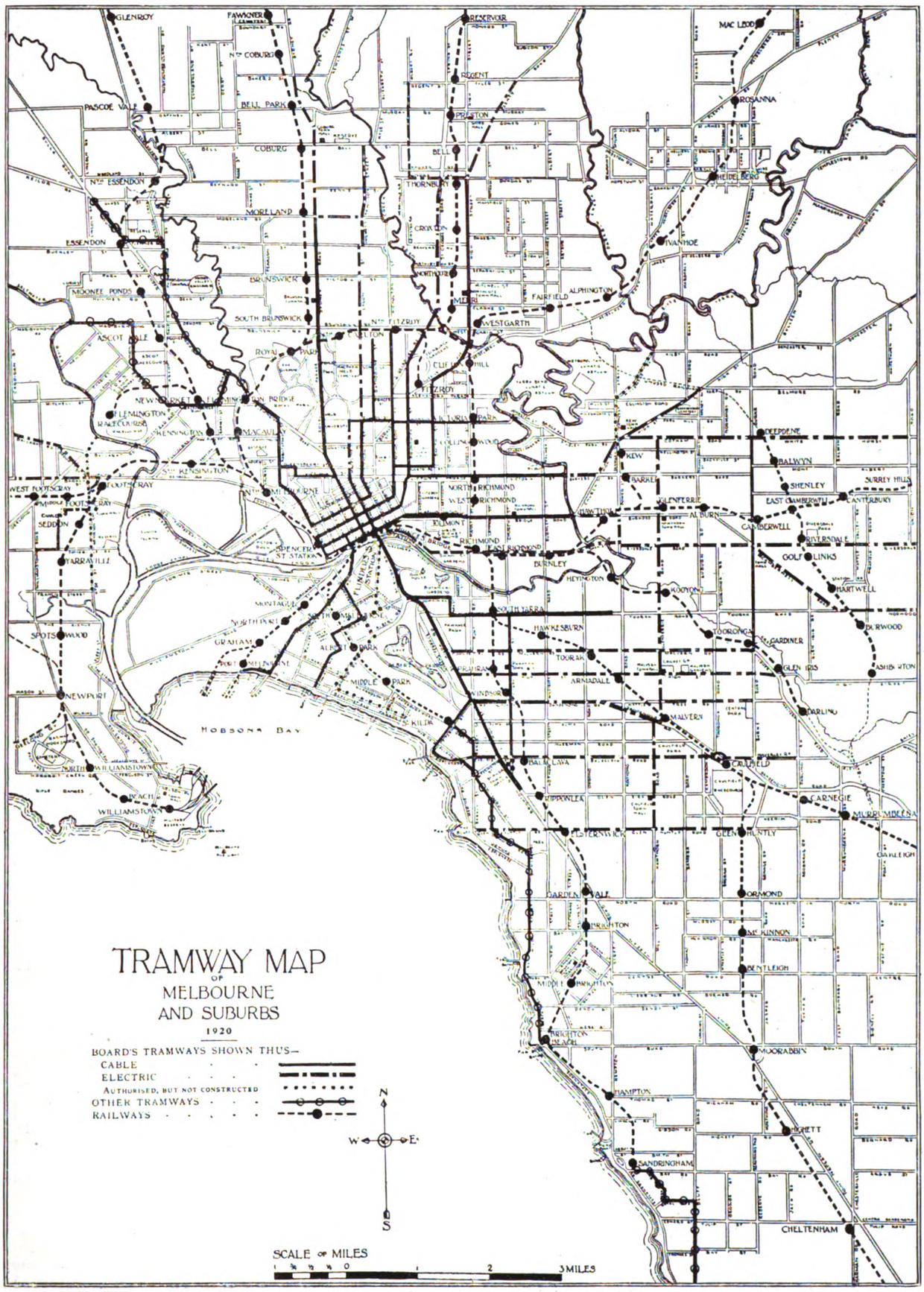

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The accountancy departments have been amalgamated and transferred to the head office under the secretary's department.

The preparation of the scheme for the tramway development of the metropolis and the construction of new tramways has been placed under the supervision of the chief engineer at the head office, but the construction and maintenance of new and existing lines will be carried out, under the direction of the chief engineer, by the engineer for permanent way.

GENERAL SCHEME FOR TRAMWAY DEVELOPMENT.

By the Act, the Board is required, as soon as practicable, to prepare and adopt a general scheme for the future development of the tramways of the metropolis. Prior to doing so, however, it must submit proposals for such general scheme to the Minister of Public Works, who is then to refer them to the Parliamentary Standing Committee on Railways for consideration and report. A special department under the direction of the acting chief engineer has been created for the purpose of collecting the information and data necessary for formulating such proposals.

Numerous suggestions for new tramways have been received from the Municipal Councils in the Board's area, and from various tramway leagues and local progress associations. The suggested tramway routes have been inspected, and will be taken into consideration when formulating the Board's proposals.

The task of preparing a general scheme of tramway development is one of great magnitude, involving as it does an investigation covering, amongst other things, the following matters—

(*a*) The existing passenger transport facilities of the metropolis, both railway and tramway.
(*b*) The conversion of cable to electric tramways at the most opportune time.
(*c*) The construction of new electric tramways to meet existing and future requirements of the metropolitan area, including provision for cross-town traffic.
(*d*) The relative functions of suburban railways and tramways, i.e., the area within which one or the other should be paramount; the area in which they more or less duplicate travelling conveniences and are therefore necessarily competitive; and the area in which tramways must be constructed so as to be complementary to the railway system.

Whilst every effort is being made to accomplish the above task without unnecessary delay, it is felt to be imperative that the investigation should be thorough, so that the scheme may be as complete as circumstances will allow.

In order, however, that the construction of new lines of tramway in districts where new facilities are urgently required may be proceeded with, without the delay necessitated by the preparation of the general scheme, the Board has asked the Government to amend its Act by empowering the Board to prepare a special scheme, setting forth a list of such lines as the Board considers urgent (and proper to be included in the general scheme), and enabling the Parliamentary Standing Committee on Railways to report upon the proposals, without such lines having been first included in a general scheme as is now required by the Act.

The total number of cars now in service is as follows—cable tramways, 561 dummy grip cars, 564 passenger cars (including 58 bogie cars); eastern system, 139 cars (including 43 bogie cars); northern system, 26 single truck cars—total, cable cars, 1,125; electric cars, 165. The greater part of the cars have been equipped with air brakes by the British Westinghouse Company.

The general manager has urged that provision should be made for a centrally situated repair shop and factory. He considers that it would be advantageous for the Board to undertake the work of supplying its own requirements in new cars so far as these requirements can be met by local manufacture, while the periodical overhauls and repairs could best be dealt with at one large shop equipped with modern appliances and machine tools. The Board have accordingly decided on the purchase of a building site in Richmond immediately north of the River Yarra. The area of the site is approximately 7 acres. It is advantageously situated near to the electric supply station and it is nearly central to the whole tramway system.

THE BOARD AND ITS OFFICERS.

The following are the first members of the Board—Mr. Alex. Cameron (chairman), Alderman W. W. Cabena, Mr. C. Templeton, Mr. T. O'Loghlen Reynolds, Hon. J. G. Membrey, Councillor E. H. Willis, and Councillor H. H. Bell.

All officers and persons employed in connection with the various systems which were taken over by the Board were, in accordance with the Act of 1918, transferred to its service. Among the new appointments made are the follwoing—

Mr. W. O. Strangward	... Secretary.
Mr. H. S. Dix	... Chief manager and acting chief engineer.
Mr. J. G. Roberts	... Manager, Cable System.
Mr. S. Robertson	... Manager, Eastern System.
Mr. M. K. Westcott	... Manager, Northern System.
Mr. R. J. Lormer	... Assistant engineer.
Mr. C. Andrews	... Treasurer and accountant.

STATISTICAL INFORMATION.

The following statistics are appended to the report—

	Cable.	*Electric.*
Population served by tramways		610,570
Gross capital expenditure	£2,105,753	£1,641,147
Mileage of double track	45·9	45
Mileage of double track (horse)	·625	—
Mileage of single track	—	19·3
Traffic receipts	£1,088,573	£383,366
Total revenue	£1,091,007	£386,815
Working expenses	£735,541	£291,268
Interest on debentures and overdrafts, etc.	—	£61,109
Balance of net revenue account for year	£360,707	—
Balance of net revenue account for 9 months	—	£26,440
Tram miles (cable 13,756,893, horse 10,648)	13,767,541	5,034,806
Passengers carried	140,400,898	53,693,790
Average maximum number of cars in use daily	458	125
Percentage of working expenses to total revenue	67·42	75·30
Average traffic receipts per car-mile	18·976d.	18·274d.
Average traffic receipts per mile of single track	£11,692	£3,682
Average traffic receipts per passenger	1·861d.	1·714d.
Average total receipts per tram mile	19·018d.	18·438d.
Average speed per hour, including stops	9 miles	10 miles
Average working expenses per tram mile, excluding power cost	10·069d.	10·866d.
Average working expenses per tram mile, including power cost	12·822d.	13·884d.
Scale of fares	1d., 1½d., 2d., 3d.	1d.,2d.,3d., 4d.,5d.,6d.
Average distance per penny	1·63 miles	1·44 miles
Average number of passengers per car-mile	10·19	10·66
Number of cars in stock	564	165
Number of dummies in stock	561	—
Number of employees	2,786	1,100
Journeys per head of population served per annum		318

Where Tramway Receipts Go.—Mr. A. R. Fearnley, general manager of the Sheffield Tramways, addressing the Comrades of the Great War in the city, said that out of every 20s. received during the past six months, wages had taken 10s. 2d., salaries 3½d., electrical energy 2s. 4½d., materials 1s. 11¼d., renewals 1s. 3¾d., interest and sinking fund 2s. 4¼d., local rates 4¾d., income tax 6¼d., miscellaneous expenditure 7¾d. These items came to 20s., so that the balance available from the receipts for disposal was *nil*.

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SEVERN BARRAGE, ROAD AND RAILWAY SCHEME.

MINISTRY OF TRANSPORT SUGGESTION TO UTILISE WATER POWER.

Owing to the great advantages which would accrue to a large area of England, the Scottish Lowlands, and Wales if the scheme is realised, an animated discussion has followed the proposal by the Ministry of Transport to establish a barrage of the estuary of the Severn, accompanied by a bridge giving road and railway facilities which are so greatly needed in the locality. The site selected for the construction of the bridge and lock is in the estuary of the Severn not far from the junction of that river with the River Wye, which has on its west bank the mercantile shipyard inaugurated by the Government during the submarine crisis. As the department which has charge of electrical matters, the Ministry of Transport has the oversight of the investigations, which it took over from the Board of Trade in 1918. The Board of Trade, under the presidency of Sir Albert Stanley, had appointed the Water Power Resources Committee to consider what could be done in the way of utilising water power for generating electricity. That committee was presided over by Sir John Snell, one of the Electricity Commissioners appointed in connection with the Ministry. The Severn project emanated from an engineering source two years ago.

PROVISION FOR OVER HALF A MILLION HORSE-POWER.

The power available in the Severn dwarfs into insignificance all the other potential sources of inland water power within the United Kingdom put together. The Severn is unique in combining in itself all the conditions essential to the economic development of tidal water power on a large scale. These consist of an exceptionally high range of tide, an estuary of large capacity, an ideal geographical situation in relation to the industrial centres of the country, suitable land along the banks of the estuary for industrial development. The necessity for immediate increased railway communication between South Wales and other parts of the kingdom, the long-felt need of access over the Severn estuary for vehicular traffic, and the possibility of combining these with a large scheme for cheaper power for industrial purposes, led to a detailed study of the whole project being undertaken by the Ministry of Transport. These studies, which have been worked out by the civil engineering department of the Ministry, have resulted in the formulation of a comprehensive scheme, one which provides over half a million H.P. during a ten-hour day with a peak load capacity of over a million H.P., at an estimated cost for generation at present day prices of a little over a halfpenny per Board of Trade unit.

In order to appreciate the magnitude of the power to be made thus available, comparison may be made with the world's greatest water power installations—

Amalgamated Niagara Falls Power Company	385,500 H.P.
Big Creek Development Pacific Light and Power Company	350,000 H.P.
Ontario Power Company	200,000 H.P.
Capdel'a, River Flamisell, Spain	150,000 H.P.
Toronto Power Company	146,000 H.P.
Keokuk Dam on the Mississippi	150,000 H.P.
Kinlochleven (Scotland)	30,660 H.P.

Incidentally, the utilisation of this enormous power would effect a saving of about three to four million tons of coal per annum, which would thus be available for export. In addition, from a transport point of view, the scheme provides for a level road for vehicular traffic over the Severn, obviating a detour for all traffic between Newport and Bristol of about 50 miles via Gloucester. It also provides for the quadrupling of the Great Western Railway Company's line when required between the West of England and South Wales at a considerably less cost than could be achieved in any other way. Lastly, the scheme creates a gigantic locked basin for shipping purposes on the Upper Severn above the line of the Severn Tunnel of over 27 square miles in extent, a very large portion of which will be suitable for the accommodation of vessels of the largest size, and usable at all states of the tide. This portion of the scheme, combined with the enormous power available at cheap rates, may be anticipated to lead to vast industrial development, and by bringing shipping further up the estuary and nearer to the existing industrial areas materially shorten the distance and lessen the cost of transit to inland places such as Birmingham.

The carrying out of the scheme would mean the employment for a period running into years of an army of men of all grades, both technical and labouring.

HOW NEAP TIDE DEFICIENCIES ARE TO BE MET.

The difficulties inseparable from any attempt to harness the tides are very formidable ones on account of the constantly changing times at which the tides occur and the great difference in the height of the tide at the period of spring and at the period of neap tides. The spring tides occur about the period of full moon and the period of new moon. Neap tides occur in between these periods. There is about five times as much water power available during a big spring tide on the Severn than there is during a small neap tide.

Another difficulty in connection with tidal power is the impossibility of generating energy at a constant rate during the day whatever system of turbines and turbine working are adopted.

These difficulties bring home to the engineer the necessity of storing part of the energy obtained from turbines working in the dam which is available during the periods of spring tides and during the period of working, in order to make good the deficiency of energy which exists during the neap tides and during those periods when the turbines are not working. The storage of energy by means of electrical accumulators is an exceedingly costly process, and is at present out of the question from an economical point of view.

The method of energy storage which has been adopted is that of pumping sea water from a low level to a high level when surplus energy is available, and of using the same water to drive other turbines in passing from the high level to the low level at periods when the stored-up energy is required for industrial purposes. Some years ago such a project would have been quite impracticable of execution owing to the low efficiency and high cost of the pumping plant which could then have been installed. Wonderful developments, however, have taken place in the evolution of the centrifugal pump, and centrifugal pumps of great size have now been designed which will raise water hundreds of feet with very high efficiency. In this case the quantity of energy which has to be stored is enormous, and an artificial salt water lake has been provided for at a high elevation in order to achieve the object desired.

In a valley not far from the ruins of Tintern Abbey there exists a site which appears to be ideally adapted for the location of such a high level reservoir. In

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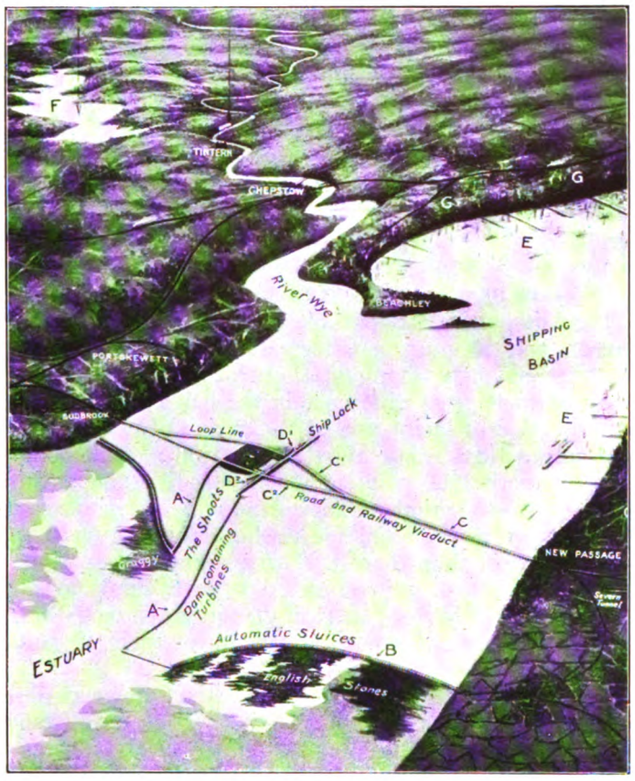
constructing this reservoir it will be necessary to build a dam across the lower end of the valley. It is intended to force the water up from the low level of the Wye through a tunnel driven through more than a mile of solid rock and made to discharge into the great lake.

There will be, the Ministry states, two separate installations required in connection with the power scheme—

(1) A great concrete dam or barrage across the Severn within which sluices and turbines will be installed for utilising the power of the tides, and with which will be combined the road bridge and the railway bridge over the Severn at this place.



Severn Barrage: A Bird's Eye Sketch.

A.A. Concrete dam containing turbines driven by impounded water and generating electricity.
B. Automatic flap sluices operated by tide, for impounding rising tidal water.
C. Road and railway viaduct.
C1 and C2. Alternative loop for diversion of railway traffic to ensure continuous railway working.
D.D. Ship lock.
E.E., &c. Piers and wharves for shipping.
F. Salt water lake for accumulating water power against neap tide deficiencies and times when tides are such that the turbines are not working.
G.G. Riverside areas lending themselves to industrial development.
NOTE.—North of Tintern, and indicated by a vertical line, is the site of power house in proximity to F.

(2) An energy storage plant comprising a great high-level lake and tunnel in combination with an immense pumping and turbine power-house on the banks of the tidal portion of the Wye.

THE DAM AND THE TIDAL AND LAND TURBINES.

The site for the dam has been the subject of very careful study. It lies close to the line of the Severn Tunnel. Nature has been kind in providing an almost ideal site; at this place the estuary is about 2½ miles wide with low-lying country on either side. The greater part of the bed of the river is exposed dry at low water, and there are great sheets of rock known as "English Stones" occupying nearly a square mile.

The upper structure of these rocks is what is known as "Keuper marl," and between these rocks on the English side and the rocks on the Monmouth shore side there is a wide deep channel worn out of the solid Pennant sandstone, known as "The Shoots." The rocks on either side shelve steeply into this deep gully, which is rather wider and very much deeper than the Thames at Westminster. It is proposed to construct the hydro-electric barrage along the edge of these rocks on either side of the river, utilising "The Shoots" or deep gully as a tail race for carrying away the water from the turbines, and an ingenious form of dam has been devised of great structural strength in reinforced concrete. Within this dam there will be chambers for the turbines and generating machinery.

The method which it is proposed to adopt in order to utilise the power of the tides in the Severn is to trap the water in the upper part of the estuary above the dam at high water so as to create an artificial difference in the level between the water thus impounded above the dam and the water in the estuary below the dam, for a period of several hours round about the period of low tide. During these hours when the difference of level exists between the water inside and the water outside, sufficient water inside will be allowed to pass through the turbines in the hydro-electric barrage to generate upwards of a million H.P. The method of trapping the water in the principal part of the estuary is a very simple one, and is effected by means of gigantic horizontally hung sluices or doors extending right across the "English Stones." These doors will automatically allow water to pass above the dam to replenish the upper part of the river while the tide is rising, and will automatically shut on the turn of the tide, and so prevent the water trapped above the dam from escaping except through the turbines.

The second installation comprises the large high-level lake and tunnel already alluded to, in combination with a mammoth pumping and turbine power-house on the banks of the tidal portion of the Wye. In this power-house electrical energy derived from the tidal turbines in the Severn, and transmitted by power cables, will be used to force water up to the reservoir at such periods as the supply of tidal power permits. When, however, the demand for electrical energy is greater than the tidal turbines in the Severn are able to supply, or when for tidal reasons the turbines are idle, this power-house will automatically cease to function as a pumping station, and will act instead as a generating station, thus being a source of supply of electrical energy actuated by high pressure turbines supplied with water from the reservoir.

One of the principal novel features of the present design is the way in which the difficulty of allowing ships to pass up and down the river without in any way interfering with or interrupting the passage of trains across the bridge has been overcome. A locking basin capable of taking the largest ships has been provided on the line of the navigable channel and intersecting the barrage. The ships will be led into and worked through this basin by electric locomotives. The railway and road traffic is passed over either end of this basin by means of lifting bridges operating in such a way as to ensure that there is no delay either to railway, road, or river traffic. This is effected by duplicating the railway into the form of a loop where it crosses the locking basin, and so controlling and interlocking the arrangements as to allow continuous free passage for the railway or road traffic on one or other branches of the loop with absolute safety.

In connection with the proposed low level bridge over the Severn in the neighbourhood of the "English Stones," it may be noted that this appears to be the most direct way of gaining access to South Wales

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from England. The present railway tunnel carrying the bulk of the Welsh traffic, which was opened in 1886, is not altogether satisfactory from a traffic working point of view on account of the heavy gradients running down into it from both sides. The reason for these gradients is to be found in the fact that the gully in the estuary known as "The Shoots" is of great depth, and it was necessary to construct the tunnel at a safe depth beneath it. One of the results of the great depth of the tunnel is that the ventilation presents difficulties.

Anybody who wishes to pass from, say, Bristol to Cardiff by road is obliged to make a detour of about fifty miles via Gloucester. The proposed road bridge over the Severn would fulfil a present great need.

NOTES ON THE TECHNICAL ASPECT.

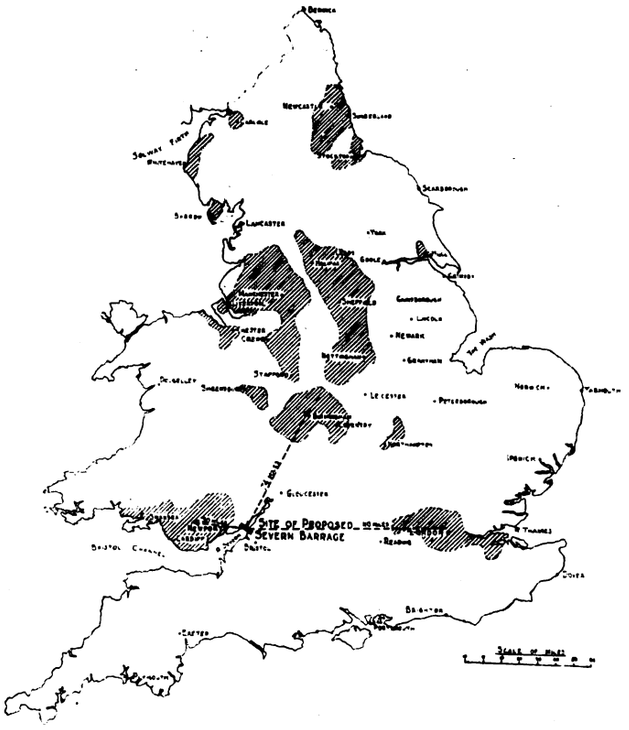
The principal characteristics which distinguish the Severn tidal power project from a hydro-electric installation of the usual description are that the power is only obtainable intermittently according to the state of the tide, and that even while the turbines are at work the conditions of head are continually varying. In the Severn barrage scheme the working period for the turbines occurs shortly after the ebb tide has commenced to run, and continues throughout the hours of low water and until the tide has risen to about half its height. Owing to the fact that the ebb tide in the Severn occupies a longer period than the flood tide, it is possible to obtain a working period for the turbines of approximately seven hours' duration, which is followed by five hours during which no power is obtainable. The head under which the turbines work would be, to commence with, about 5 feet, and towards the middle of the 7-hour working period it would increase to a maximum (on spring tides) of 30 feet.

The type of turbine contemplated is "mixed flow turbines," the runners being of 10 ft. diameter with axes vertical. With this type of turbine it is essential in order to obtain the highest efficiency at every head, that the turbines are run at a different speed for each particular head. The first difficulty which is to be overcome (the Ministry of Transport states) is to adapt the electric generator to the varying speeds of the turbine. In the case of the Severn installation the turbines would rotate at speeds approximately between 40 and 80 revolutions per minute. It is proposed in this case to drive the generator through helical gearing having a ratio of approximately 7½ to 1, and producing generator speeds of between 300 to 500 revolutions per minute.

The generator proposed is a direct current dynamo of special design with vertical axis. These machines would be separately excited with shunt characteristic. The control would be effected either automatically or by an operator controlling the excitation and load currents of the dynamos in such a way that the resisting torque offered by the dynamo would be such at any moment as to prevent the turbine from rotating at a speed greater than the theoretically correct speed for maximum output under the particular head of water which happened to prevail at the moment in question. The operator would, of course, be guided by an indicator, which would show him what head of water he had to deal with at every moment. The greatest rate of change of head which is anticipated will be 10 feet increase or diminution in the hour.

Dynamos would be required to produce current at the varying speeds but at constant voltage of 525 volts, the average output of each dynamo being approximately 1,300 kilowatts. The direct current so produced will be passed into rotary converters of large capacity, which will produce alternating current of 330 volts. The static transformers would transform up to from 330 to 60,000 volts, the tension at which it would be proposed to transmit the energy. The energy would be transmitted direct to industry from the tidal turbines. At such times, however, as the tidal turbine installation was producing a greater amount of power than that which could be absorbed by industry, the residue of the power would be transmitted a distance of about 10 miles up to the storage reservoir, where it would be made use of to drive motors, which in turn drive centrifugal pumps to force water up into the high level lake.

The motors which it would be proposed to make use of would have a speed of about 375 revolutions per



Relation of the Severn Barrage to Industrial Areas (Shown Shaded).

minute, working at 2,200 volts with output of about 13,000 kilowatts. The type made use of would, in respect of 90 per cent. of the motors, be induction alternating current motors, and in respect of the remaining 10 per cent. synchronous alternating current motors. The induction motors would be used as being cheaper and more easily parallelled. The purpose of the synchronous motors is to keep up the power factor when these are acting as motors, and to supply wattless current to the induction machines when the whole are acting as generators. In order to save the cost of installing two sets of electrical machines at the storage reservoir it would be proposed to combine in one machine the motor for driving the centrifugal pumps and the generator which is to be driven by a turbine when the storage reservoir is giving forth power.

MAXIMUM OUTPUT AND ITS DISTRIBUTION.

Whereas the amount of energy to be derived from the tides in the Severn average, week in and week out, about half a million horse-power for a 10-hour day,

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it would be proposed to instal machinery at the storage reservoir to give a maximum or peak output of approximately one million horse-power.

As regards the distribution of the energy, four principal outlets are to be looked for. The first of these is in the immediate neighbourhood of the Severn, and would be created by the growth of industries requiring cheap power on the banks of the dockised river, in very much the same way as there have arisen a group of power-absorbing industries in the neighbourhood of the Niagara Falls. The second outlet for the energy would be in the industrial area of South Wales, the whole of which lies within a radius of 50 miles of the Severn barrage. A third outlet for the energy would be found in the English Midlands. Birmingham is approximately 70 miles and Stoke-on-Trent approximately 100 miles distant from the barrage. It is anticipated that there will be considerable difficulty in setting up of steam super power-stations in the Midlands on account of the lack of condensing water available in that area, and on this account the supply of the Severn power would be particularly advantageous for supplying the Midlands. The fourth outlet for the power is the Thames Valley and London. London is situated at a distance of 115 miles from the barrage, and it may be possible to transmit the energy at 120,000 volts in this instance. The cost of the transmission line to London and the loss of energy which may be expected therein, is not by any means so formidable as might at first be supposed.

The cost of a transmission line to London capable of conveying half a million kilowatts with a 10 per cent. loss in the line would be approximately one and a quarter millions sterling. The cost of the line and the transmission loss taken together would therefore only add a small fraction of a penny on to the cost of the B.O.T. unit delivered in London.

It is thought that the appropriate use for the electrical energy of the Severn, having in view the storage reservoir and storage power house which is capable of producing peak load output at short notice, is to apply the energy to take up the peak load in industrial areas. That is to say, the Severn scheme can be made to work largely in conjunction with steam generating stations in such a way as to enable the latter to work with a load factor of from 70 to 80 per cent. instead of from 20 to 50 per cent. as at present.

It would be noticed in the arrangement which has been briefly indicated above that the only machines which are not always running at full load are the dynamos in the tidal turbine installation. All the other electrical machines work under conditions of full load, and therefore under the best conditions for efficiency. The existence of the storage reservoir would enable the output of the tidal installation to be absorbed at all times. The number of machines in the reservoir installation which would be employed as generators at any particular time when the supply from the tidal installation was in abeyance or insufficient would depend on the demand from industry.

Wearing of Goggles by Motormen.—The District Council of the National Joint Industrial Council for the tramway industry have decided that motormen driving electric cars should be allowed to wear goggles, subject to the cost being borne by the employees concerned. The Highways Committee of the London County Council recently authorised the general manager to arrange for the approval of the pattern of goggles to be worn by motormen in the Council's service.

ABERDEEN CORPORATION STANDARD CAR.

Mr. William Forbes, general manager of the Aberdeen Corporation Tramways, has recently completed at the tramway workshops eight double-deck cars. The cars are attractive in appearance, and are specially

Aberdeen Car with Enclosed Vestibule.

well finished, as will be seen from the accompanying illustrations. They have been put in service on the "circular route," a sight-seeing route round the city usually taken advantage of by visitors, and have proved very popular. The fine appearance of the cars,

Interior of Aberdeen Standard Car.

combined with the comfortable seating arrangements, have made the car popular, and the tramways department has decided to adopt this type of car as their standard type. Mr. Forbes has now been authorised

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to build an additional six cars of the same design and dimensions, which are as follows—

Length over all	30 ft. 6 in.
Length over dashers	29 ft.
Length of platforms	5 ft. 10 in.
Length of car body	17 ft.
Breadth of car body	6 ft. 8 in.
Height inside lower saloon ...	6 ft. 5½ in.
Length of top deck	17 ft. (cover)
Breadth of top deck	7 ft. 1 in.
Height inside top deck ...	6 ft. 4 in.
Seating capacity (saloon) ...	24
Seating capacity (top deck) ...	36
Total seating capacity ...	60

Corner posts, side posts, and rails are made of selected ash, and the doors, sashes, and mouldings are made of mahogany with Japanese oak panels. The interior finish of the roof is of alternate light and dark stained pitch pine linings with ash supports. The ventilation of the car has been well provided for, as will be seen from the illustrations. In addition to the window ventilators, four Eros type air extractors have been fitted to the top deck roof.

The car bodies, to which end vestibules have been fitted, are built on steel underframes, and are mounted on Brill No. 21E trucks. Each car is equipped with two Westinghouse No. 323 V.B. 35 H.P. interpole motors, two Westinghouse magnetic track brakes, and Peacock hand brakes.

LONDON'S QUEUE PROBLEM.

Mrs. Hudson Lyall, a member of the London County Council, is strongly advocating the institution of queues for London to obviate the daily scramble for tramcars and omnibuses. At a recent meeting of the Council the following resolutions standing in her name were passed—

(1) That it be referred to the Highways Committee to consider and report whether more shelters can be provided and queues organised at busy tramway stopping places such as at Victoria; (2) that it be referred to the Local Government Records and Museums Committee to consider and report whether representation should not be made to the Commissioner of Police of the Metropolis and the Minister of Transport as to the necessity for framing a by-law providing for the formation and regulation of queues at all stopping places, whether for tramcars or omnibuses.

PROBLEMS OF ROAD TRANSPORT.

"Economies and Co-ordination of Transport by Road" was the title of a paper read at the Institute of Transport on November 30 by Mr. Shrapnell Smith. The country, he said, was on the threshold of a national movement to turn coal resources to better account, so that its solid, liquid, and gaseous contents should be separately applied in accordance with scientific knowledge and economic needs. Coal must bear its share in redressing the motor fuel shortage. He hoped that there would be a steady improvement of relationship between owners and employees in the road transport industry on co-partnership lines. Co-partnership was a better cure for industrial unrest than nationalisation. A new phase of possibility had been opened for electrical vehicles in connection with the development of large power stations.

Hadfields' New Issue.—It is stated that £800,000 of the recent issue by Hadfields, Limited, of £1,000,000 of 7½ per cent. first mortgage debenture stock was applied for by the public, and that offers have been made to relieve the underwriters of their liability for the balance at the issue price, less underwriting commission on the amount so taken over.

TRAMWAY RETURNS FOR 1918-19.

TRAMWAYS—FINANCE AND STATISTICS.

The report relating to tramways, light railways, and trackless trolley undertakings, formerly issued by the Board of Trade, but suspended owing to the war since the year 1913-14, has now been compiled by the Ministry of Transport, in respect of the year ended December 31, 1818, for companies, and March 31, 1919, for local authorities. Returns for the year ended December 31, 1919, and March 31, 1920, are in hand and will be issued early next year.

The white paper now issued embraces some new features which have not hitherto been published. In addition to the net receipts from the operation of tramways, particulars are given of the income derived from other sources, and the total net income available for distribution. The income and expenditure, on revenue account, of tramways which are not worked by the owning companies or authorities are included for the first time.

The statistical tables have been separated from the accounts and considerably amplified to include for each undertaking the average number of cars in use, traffic revenue per car mile, car miles run per car per day, working expenses per car mile, fare per passenger, distance passengers conveyed for each fare, fare per mile, and number of units of electrical energy used per car mile, etc.

The total capital expenditure on tramways in the United Kingdom to the end of the financial year 1918-19 was £82,842,722, an increase of £1,864,884 or 2·3 per cent. compared with 1913-14. The gross receipts during the year 1918-19 were £24,635,266, and the working expenditure £17,751,277 leaving the net receipts amounting to £6,883,989. It must be borne in mind that the maintenance and renewal work undertaken during the year 1918-19 was owing to war conditions inadequate, but in spite of this the ratio of working expenses to receipts was 72·06 per cent., as compared with 64·35 per cent. in 1913-14.

The number of car miles run during 1918-19 was 9.59 per cent. less than in 1913-14 but the number of passengers carried increased by 33 per cent., as shown in the following tables—

CAR MILES RUN.

	1918-19 Miles.	1913-14 Miles.	Decrease.	
			Miles.	Percentage.
Local Authorities	244,162,588	262,675,163	18,512,575	7·05
Companies ...	76,215,788	91,704,509	15,488,721	16·89
Total	320,378,376	354,379,672	34,001,296	9·59

PASSENGERS CARRIED.

	1918-19 Number.	1913-14 Number.	Increase.	
			Number.	Per-centage.
Local Authorities ...	3,632,525,882	2,696,759,064	935,766,818	34·70
Companies ...	925,114,196	729,714,128	195,400,068	26·78
Total ...	4,557,640,078	3,426,473,192	1,131,166,886	33·01

The Elasta Lamp.—At the invitation of the directors of Pope's Electric Lamp Company, Limited, a visit was paid to the company's works at Hythe Road, Willesden, on December 6. Drawn wire, vacuum, and gas filled types of Pope's carbon filament lamps are made at this factory, and the whole process of manufacture from the drawing of the wire to the packing of the finished article was seen in operation. The high quality and remarkable uniformity of the Elasta lamp is due to the skill of the operative staff, coupled with the most competent supervision. The equipment and organisation of the works are thoroughly up-to-date. As an example of the pains taken to secure the best results, we may mention that although many of the processes of the manufacture of the vacuum and gas filled lamps are exactly similar, the entire manufacture of the two types is kept separate and distinct. The works are frequently taxed to their utmost capacity in order to cope with the constant expansion of the business, and it has recently been found necessary to make room by removing the sales organisation to Elasta House, Arthur Street, New Oxford Street, W.

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THE EDITOR will be glad to consider articles by experts. All information of a practical character relating particularly to the engineering and operating branches of transportation will receive prompt attention. Original illustrations will also be welcome.

LONDON, DECEMBER 16, 1920.

The Current Price of Cars.

Tramway owners and even many users of tramways have noted with a feeling of alarm the high prices that the London County Council is to pay for 125 new cars. The lowest tenders, sent in under conditions of free competition, are in themselves staggering. That the prices of various materials and equipment are three and sometimes four times as high as they were before the war is well known, but these new cars are to cost almost exactly five times what they could have been bought for in 1910. The present price per car in round figures is £4,300; in 1910 it would have been £880. There is no suggestion that the present price is unfair, or that it is not warranted by existing conditions. The fact is that the difficulties of engineering manufacturers have since the war become enormous, and as yet there is no sign of improving conditions. It is true that in some directions the scarcity of materials is hardly so acute as it was, but there is no relief as to price. In wages any prospects of change appear to be in the upward rather than in the downward direction. Whether any improvement is becoming marked in the output in return for the high wages paid does not yet seem very clear, but it is well known that since the war one of the greatest troubles in engineering manufacture as in many other businesses has been the "go easy" policy of the workmen. This, coupled with the shortening of the working hours, has produced an increased cost for labour of which the increase in wages per man is only a part. How the high price of the cars in question is spread over their components may be gathered from an examination of the figures published on another page of this issue. Tenders are given separately for bodies, trucks, electric equipment, and magnetic brakes. How then can tramway undertakings, especially the poorer and smaller ones, afford to obtain new rolling stock when required? The situation is as bad if not worse than that associated with renewing the permanent way. Apparently the only thing to be done for the present is to keep down renewals and additions to a minimum. The present state of markets cannot go on indefinitely, and the slackening of demand must lead to cheaper material and reduced cost of living, conditions favourable to lower wages. These things, however, will have to come all round; they cannot be looked for in connection with the tramway industry alone. That the manufacturers do not anticipate a favourable change soon is shown by the fact that—as has been usual lately—the prices quoted are not "firm," but are to vary if costs alter during the period of manufacture. The necessity for a variation clause in contracts is one of the great troubles under which British manufacturers are suffering.

Unnecessary Expenditure.

The latest appointments by the Minister of Transport have given rise to some criticism. Half a dozen officials have been appointed in various parts of the country for the purpose of keeping the Ministry acquainted with new transport requirements, and for other duties of a like non-arduous nature. Several of them are ex-military officers, and in no case has the Ministry ventured to inform the public of the fitness of the officials for their task. Hitherto proposals for light railways, whether electric or steam power is used, have come before the Light Railway Commissioners, and of late years the Development Commissioners have been empowered to assist such schemes with grants. The latter

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body has also considered proposals for aiding road motor transport, though in no case have they seen their way to give assistance. If these bodies are to continue to exercise their functions it is difficult to grasp the need for the latest appointments. New rail or road transport schemes have in any case to be first submitted to the local authorities, whether emanating from a public body or from private promoters. In due course the applications are transmitted to the central authority in the case of rail projects. Company motor undertakings need only the assent of the local authorities; plans involving the spending of public money must be authorised by Parliament. To appoint extra officials to do work which will be performed by promoters savours of duplication. Moreover, if the new task is necessary, it might be relegated to the chief of the new road engineers who are being appointed in each county for road maintenance and construction. To these engineers the County Councils will delegate the task of reporting upon new rail and motor proposals, just as in the past the chief road surveyor has discharged such duties. The most charitable attitude towards the appointments is to assume that they are due to the preparations which have been made for maintaining means of communication in the event of a miners' strike.

Melbourne Tramways Board.

The first annual report of the Melbourne and Metropolitan Tramways Board, a summary of which appears in another column, deals with the transition period through which the unified tramway systems of that city have just passed. It was to be expected that in the first few months of working under joint control, certain difficulties might arise between the different parts; but nothing of this kind seems to have occurred. On the contrary, the changes effected appear to have had most beneficent results, and after six months' working, staff and passengers alike have had equal cause for satisfaction. On the one hand agreements have been reached providing for equitable increases in wages, placing the employees from all lines on the same footing and providing for a six-monthly adjustment based upon the rise or fall in the cost of living as determined by the Commonwealth Statistician but with the minimum rate fixed in 1919. Beyond the wages agreement, the employees on all lines are now admissible to the Cable Tramway Employees' Mutual Benefit Society, to which the Board contributes on their behalf; moreover an "Appeals Board" has been established to deal with any grievances that may arise. On the other hand, the convenience of passengers has already been greatly promoted by the increased efficiency resulting from joint working, by the establishment of through services not previously possible, and by the adjustment of time tables so that neighbouring termini shall provide connections whenever this can be arranged. The administration of the city tramways has been largely centralised so that the increase in the volume of traffic catered for during the year has not necessitated serious increases of staff. Economies effected have been so satisfactory that fares have in no case been raised, while certain cheap fares have been instituted. From the point of view of future development, the amalgamated tramways are clearly in a greatly improved position, and the chief engineer has in fact been engaged on the preparation of a general scheme for the provision of adequate passenger transport facilities throughout the city. On completion, this scheme will be submitted to the Parliamentary Standing Committee on Railways for their report, and there can be little doubt that the final plan adopted will thus be the most satisfactory that could be devised to meet the situation. Pending the termination of the work on this general scheme, however, the Board is seeking power to submit interim proposals for the construction of certain lines that are urgently required and will fit in with the general scheme. On the showing of this report, Melbourne should have every reason to be well pleased with the unification of her street transport services as the only means of attaining real efficiency. The importance of such unification is becoming very widely recognised, as is shown by the fact that the Paris authorities have availed themselves of the first opportunity to bring their various undertakings under centralised control, and now the pressure of economic conditions has compelled the numerous agencies previously operating in Berlin to take refuge under a single direction. In London, the futile traffic war

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still continues, and there are, of course, very serious difficulties in the way of the co-ordinating settlement; none the less it will have to come eventually, and the longer it is delayed the longer will the public have to wait for adequate facilities at the minimum cost.

Tramways on New Main Roads.

Liverpool Corporation seems likely to be the first to put schemes for new roads and the widening of others in operation as work for the unemployed. With the co-operation of the tramways department, Mr. Brodie, the city engineer, is to have the opportunity of further extending the city's boulevard scheme of main roads with tramways constructed with rails laid on sleepers, thus reducing cost of construction, running, and renewals, as is essential to remunerative working at the present time. Manchester, Birmingham, Leeds, and Sheffield are moving in the same direction, while every effort is being made to ensure a start upon new thoroughfares in the north-eastern outskirts of the Metropolis. In the carrying out of these works the cost is to be shared by the Government and the localities, a circumstance which may involve some measure of control by the Roads Department of the Ministry of Transport. It is a happy augury that this year the city engineer of Liverpool is the president of the Institution of Civil Engineers, to whom, on November 2, he delivered an address pregnant with ideas for tramway and omnibus managers and car builders, as well as for road engineers. To take only one point—the provision of high speed sleeper-constructed tracks. It would not be out of place if the Ministry secured, for the benefit of future schemes, the cumulative statistics of sleeper track construction for tramways in this country, for it goes back many years. The importance of the system was emphasised in regard to economy and speed by Mr. Hamilton at the last Municipal Tramways Conference, and the need for its adoption is rendered all the greater by the distance of new housing sites from the centre of the towns. This will be especially the case with the Dagenham housing estate of the London County Council. The plans for the new road and widenings to serve what will be a great town include a separate road for tramways, to link those already serving the docks to the east of the Tower. Besides connecting West Ham with Dagenham, this road will increase the facilities for traffic between London and the distant Tilbury Docks. Important as the project is, it is only one of four involving a total outlay of about ten million pounds on new roads in the north-east sector. Those thoroughfares will open up undeveloped land, and provide alternative routes for traffic now congesting roads running through London. Suburban railway traffic in this sector long ago reached the saturation point for steam haulage, and the central authority should see that proper provision is made for high speed tramways.

NEW LONDON UNDERGROUND ROLLING STOCK.

IMPROVED DESIGNS AND MORE SEATING CAPACITY.

Trial runs were made with the first new train on the Piccadilly line of the London Electric Railway on December 8. Forty cars were ordered a year ago from Messrs. Cammell Laird and Company, and are now being delivered. Each car measures 50 ft. overall and has seats for forty-four passengers. Straps are replaced by hand poles both vertical and horizontal, which are within easy reach. New door arrangements are a special feature. Each car has one double and two single sliding doors, and these doors are electrically controlled and operated by air. The mechanism is so devised that if the door in closing comes in contact with a passenger its action is reversed at once. Moreover, the train cannot start until every door is closed. The carriages are constructed entirely of steel, and have elliptical roofs. They are well lighted by lamps in the centre of the roof the whole length of the car, while emergency lighting can be supplied by accumulators. The new train ran with notable smoothness, and is much quieter than the old stock. The seats are of new design and very comfortable. It is proposed to build up gradually a six-car train service by using in each new train some of the older cars. The forty new cars will represent a total gain of 1,760 seats, or more than 26 per cent. of the existing capacity of the Piccadilly rolling stock. The total cost of the forty carriages will be about £120,000. The first cars of the new rolling stock for the District Railway will be delivered in a day or two. These cars will come into use early in the year. They will cost about £7,300 each. We hope to give an illustrated description of the new rolling stock in our January issue.

TELEPHONE CONTROL FOR L.C.C. TRAMWAYS.

The London County Council Tramways are about to instal the Selector telephone control system as designed by the Western Electric Company, which is in operation on the West Ham Corporation Tramways and on certain railway undertakings. In addition to providing selector stations, which can either call or be called as in the case of the existing external telephones, the Western Electric system permits the inclusion of non-selector stations which can call but which cannot be called from the control office. The principle of the system is that the controller shall be in immediate touch with, and shall record all items of importance occurring on the system, this information being readily accessible to those in authority. The committee propose that in the first instance the system should be installed on the northern tramways. It is expected that the installation will be completed in about nine months.

THE PECKHAM TRUCK AND ENGINEERING COMPANY, LIMITED, have made arrangements to increase considerably the scope of their activities, and for that purpose larger offices have been taken at Audrey House, Ely Place, London, E.C.1. Changes in the directorate are also announced. Mr. O. T. Gibb, who for a number of years represented Messrs. Dick, Kerr and Company on the Board, has resigned and severed his connection with the company, whilst Mr. Sidney Thomas, who is widely known in the tramway world as engineer to the company since its inception, has been appointed managing director, and Mr. J. H. Nicholson, well known in engineering circles, has accepted a seat on the Board. The company are now in a position to execute orders, not only for their own specialities, namely, pendulum single 4-wheel trucks and pendulum maximum traction trucks, "Thomas" non-automatic brake adjuster, Eureka track brake, etc., but for all kinds of tramway accessories.

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THE FIXING OF A FARE.*

By FRANK PICK.

In the presidential address of Lord Ashfield given before the Institute of Transport there is a paragraph of which the pertinent portion runs thus—

> "Yet transport is not a science so much as the practical application of many sciences to the solution of a special type of problem . . . All these establish principles of which transport affords illuminative illustrations in practice."

It seemed to me that I could hardly do better than take the thought of this paragraph and present to you a full length picture of it as my address. And for this picture, I have resorted to a subject which has engaged a good deal of my time this last year, the fixing of fares; for, as you may all now know by personal experience, the fares have recently been increased on every system of passenger transport in London.

I believe there are still people who think that if a fare is 3d., you may just make it 4d. or 5d., not to taste perhaps, but at any rate according to the richness of the desired result, without ulterior thought. I suppose you will hardly come into that category. My friend Mr. Stephenson, who now lectures to you instead of me, will have already unfolded to you some of the mystery of fares fixing. I want if I can to set the whole matter in a bare, cold light. There is no occult mystery at all, though the man who preceded me on the commercial side of the Underground management always taught me there was. The fares in use in his time were openly anomalous, but if you asked why, he never would give an answer. I fancy he never could. For there was no discoverable reason but this, that so long as they were anything other than a mere relation of pence to miles, he always remained an important person to be consulted about them—a true priest within the shrine. Yet to-day, when as far as may possibly be the whole body of fares has been brought into harmony and when some recognisable rules and measures govern the way in which they are fixed, I am going to try to show you that it is still a mystery in a very different sense, and that behind it are a great many solemn and august problems.

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First of all, there are statutory and legal provisions which exercise, or are supposed to exercise, a controlling influence over the fixing of fares. For example, the London Electric Railways (Fares, etc.) Act, 1920, establishes maxima within which the fares to be charged must be brought. This is the first post-war act of the sort, and permits ordinary fares up to 1½d. per mile with a minimum fare of 2d. The notion underlying such a statutory provision is that the railways are not subject to competition and, therefore, the economic factor is inoperative to prevent excessive fares. A false notion twice over. First, because there is competition. The unregulated motor omnibus has usually undercut the railway. Second, because without competition the economic factor remains effective. A thoroughly expensive urban railway depends on the bulk of its traffic for its success far more than upon the rate of its fares.

However, since the war a new school of thought has arisen which seeks to do away with maxima. The Ministry of Transport has set up new machinery for controlling fares as they exist in fact. The railways are unwilling to trust themselves to a fixed amount that is reasonable to-day fearing what level of price the morrow may reach; and the potential passenger is similarly untrustful hoping that the morrow will show a fall. If the withdrawal of maxima is to mean that fares are to be fixed by an outside tribunal, then the step will be bad. No outside tribunal takes the full responsibility for the consequences of its decision, nor can it share the living experience of those engaged in the regular commercial work of transport. It weakens management without substituting a better alternative. If, however, the withdrawal of maxima is to mean that the general limits within which fares are to be fixed shall be drawn from time to time by an outside tribunal to suit the circumstances then, if there is left some discretional margin for good and skilful adjustment within those limits, the step must be a good one. It substitutes flexible for arbitrary bounds.

On the legal side there are provisions against discrimination and undue preference; but owing chiefly to the reasonableness with which fares have been fixed in the past, there is not any volume of judicial decision on the points, and they remain largely undefined. Luckily it was made clear as far back as 1840, that a maximum scale of charge based on distance did not imply actually a uniform scale of charge corresponding to the distance carried; that short distance fares might be high compared with long distance fares when measured in rates per mile. This is the Underground practice. It was similarly made clear at an early stage that equidistant points from a centre were not *ipso facto* entitled to an equal fare, so that some regard might be had to the need of development, or the ability of the passenger to pay, district by district; so that, say, the east end of London might enjoy lower fares relatively to the west end. Again, the flat fare was held not to be necessarily illegal. At the very outset the mystery of fare fixing was not ruthlessly abbreviated.

So much for law. That is study number one.

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Having escaped the horrid arbitrariness of the law, we cannot escape the determinism of geography. Everywhere geographical facts condition the fixing of a fare. Let us look at London from one or two aspects just to see this.

The earliest London was founded on a patch of high ground near the river amid a waste of marshes and pools—the hill of St. Paul's as we can see it still. It stood at the point at which it was first possible to bridge the river coming up from the sea, and so open up communication from shore to shore. In a real sense the bridge was London. Standing back from the river, three or four miles away on either side was a line of hills, now topped with Hampstead and Highgate on the north, and with Norwood and Sydenham on the south; and between these encompassing hills London grew eastward and westward along the river banks, so that now it runs from Ealing to East Ham, a distance of 17 miles east and west, and from Hampstead to Sydenham a distance of 11 miles north and south. This variant length of London's axes must be kept in mind in fixing fares. Fares north and south might be expected to be on a somewhat higher scale than fares east and west. It was so before the war, and would be so now if it were not that the outlying east and west fares fall under the flat 75 per cent. surcharge scheme of the Government.

Even the facts of physical geography have a bearing. The thick bed of tenacious clay spread beneath London has induced the construction of deep-level tube railways. The high capital cost of such railways affects the general level of fares and demands dense traffics to maintain on their behalf anything approaching equality of charge with surface transport. Contrast the low rocky islet at the mouth of the Hudson river, most like a scrap of the Hebrides, upon which New York is built. I remember seeing a building site to let which consisted of a sharp jutting crag some 20 feet high above the roadway. There the native rock still asserted itself. It was almost humorous as it poked its nose up amid the square-set tenement houses. Because of this rock, the Subway, or Underground of New York, is shallow, just beneath the street in a blasted trench roofed in, just as costly to construct as London, but less expensive in the working of stations for the absence of lifts and escalators. And because of their foundation on this rock, there are the skyscrapers, 20, 30 and 40 storeys up in the air, streets on end, creating the unsurpassed congestion of traffic of which an American might be proud, and enabling the Subway, despite its 20 miles of length, nearly to meet its liabilities on a five cent flat fare.

But the cardinal geographical fact is the distribution of industry. Industry has a limited choice of location, and it is industry which settles where we must live. It is the real cause of settlement. Even when Tacitus said of the Germanic peoples that they built their homes "as spring or field or wood happened to invite them to settle." he was not wholly accurate. They were not prospecting pleasant country residences, as might appear, but places where their simple mixed agricultural and pastoral economy might be satisfactorily demonstrated. So to-day industry still determines where we must live. It denies the upland charms of Kenwood to a university quarter. A review of London sets out its docks, its government centre, its factories, warehouses and so forth—each has its appointed district. Around them will be the houses of the workers and further away will be houses according to the development of the transport facilities, and according to the moderateness of the fares charged for their use.

This foreshadows the last point in what I have to say under this head. The most important phase of transport for a metropolis like London is the conditions governing growth. Think again of earliest London with its few thousand ancient Britons on the hill. There was no transport problem. Then for a dozen or more centuries the ambit of the city was a mile or so north and south, and maybe a couple of miles east and west. Through all these centuries, the population shifted between 50,000 and 100,000 as the hazards of plague and war allowed. Everyone walked. Not until the 16th century was there any marked growth, then it slowly expanded until the Great Fire. This was a quickening influence. Citizens of standing and substance commenced to live in newly built houses in the country at Clerkenwell, Hoxton, St. Giles-in-the-Fields, Marylebone, Newington Butts, and other salubrious resorts; so that a writer of the time described London as consisting of two cities, one borough and 46 ancient villages. Its area covered 19 square miles and its population was about 250,000. The Thames wherry and the hackney carriage had arrived, and were in bitter competition, and the sedan chair had been introduced to relieve the congestion of the streets. The cost of travel was a little over 6d. a mile, and at current price levels something of a luxury. No one had to travel very far so under these conditions the 18th century showed a steady accretion.

* A Lecture delivered at the London School of Economics, on November 18, 1920.

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Then came the mad rush of the 19th, recorded for us in the census tables. The 19 square miles had a population of 800,000 in 1801 and all the rest of present Greater London only 300,000 more. By 1841 the 19 square miles had become immerged in something like the present London County of 118 square miles, with a population of almost 2,000,000 and with still only some 300,000 more in all the rest of Greater London. But by 1901, the 118 square miles of London County had become immerged in the 693 square miles of Greater London with a population of 6,500,000. Then an outer London is again discovered stretching away to the 30 mile circuit with another million people looking to London as their centre, and London in this widest and most true sense will soon involve 10,000,000 souls. The first omnibus appeared on the scene in 1829 running from the Yorkshire Stingo in Paddington to the Bank, for a fare of 1s., including the free use of a newspaper. The first railway entered London in 1837. The first Underground opened in 1863. The celebrated penny a mile era had dawned. That is a bit of historical geography.

And the moral is that a scheme of fares must have regard to the expected range of the traffic. It must provide facilities for travel within the means of the passengers for the whole range of journeys. As London grew outwards, the local railways kept reducing their fares until in the year before the war, contrary to the practice of the main line railways which still stuck grimly to the penny-a-mile Parliamentary bargain, the London fares were only just over a halfpenny-a-mile, and London in response had spread out to the 10 mile circuit. One consequence of the war has been a destruction of standards of value, and unfortunately there is no fresh standard yet in sight, so it is difficult to conduct this argument further at the moment. Yet London is still spreading out and reaching the 15 mile circuit with a solid mass of houses. There is the famous town-to-be of Beacontree which the London County Council are to build on the flats of Dagenham. There is the quondam munition centre of Hayes, the satellite town of Welwyn, Daily Mailville. All these will look to London as their parent, and a new synthesis of fares must be reached if their prosperity is to be achieved. A scheme of fares must envisage all this. This is where the main line railways seem to have failed when in the past they commenced elaborating the present fares scheme—but I have said more than enough here for the encouragement of geography. Study number two.

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A city or metropolis is a living organism, and it is not possible to isolate one set of facts about it. This problem of growth has other implications of more interest. A scheme of fares must stimulate growth, because it is a healthy symptom and connotes the public welfare from a modern standpoint. This idea is at the bottom of the flat fare schemes of the mushroomlike American cities. A nickel (five cents) and you go where you like, and you went to a new frame house on the prairie edge. That is all very well up to a point. The American record transcends that of London. It is a staggerer. Detroit and Cleveland forty years ago were modest towns of about 140,000 people; now they turn the million each. They occupy space. As soon as the run of the journey exceeds six miles the nickel wears thin. Now that it turns eight miles the nickel will not do. It has been too stimulating.

The American flat fare dies hardly. Rather than give it up all sorts of higher flat fares are being tried. According to the report of the Federal Electric Railways Commission of August this year, 10 cents is being tried in 69 cities, 9 cents in 2, 8 cents in 30, 7 cents in 171, and 6 cents in 149. And here there is a comical conflict of opinion which is both a warning and an object lesson for you. Dr. Delos F. Wilcox, the expert called in by the Commission to advise them, affirms that any increase over seven cents is pernicious, because it destroys the public utility character of the undertaking and curtails the riding habit. He adduces a table of figures in support. The street railway association counters with another table and a contrary opinion. It is an apposite illustration of the way in which to select evidence to prove anything. Each side picks out those results that suit its views, taking some cities into account and ignoring others. But behind the inconclusiveness of the particular results chosen, there is the general tendency for increases in fare to restrict travel, and there must be a point at which a flat fare scheme is impossible if the social effects of it are to be considered, as they surely must. It is only necessary to skip across to war-stricken Berlin to see this. My story is not as complete as I should like, but it would seem that this year the street railways of Berlin have tried successively a 30 pf. (4d.), 50 pf. (6d.), and 70 pf. (9d.) flat fare, and have continuously failed to secure a revenue adequate to pay their operating expenses. The fares simply killed the traffic. These exaggerations of such a scheme are unwholesome developments.

I may be permitted a digression at this point, because it illustrates an interesting method of fixing fares, and one which is a natural concomitant of a flat fare. There is a type of franchise agreement entered into between an American municipality and a street railway undertaking which is called a " service at cost " agreement. At the end of a year or other period the cost (including in that term working expenses, depreciation and renewals, and a fair return on capital) of carrying a passenger is averaged out, and whatever this gives in cents is the flat fare for the ensuing period. Thus the passenger knows just why he pays so much. He knows too that the more frequently he travels, the cheaper in all probability will be the fare, for the fare goes up or down not only with the cost of the service, but with the average density of the traffic. It is not an unsound method, but difficult, if not impossible, of application to a differential fare system such as is characteristic of London.

London has had its own experiment in the flat fare. The " twopenny tube " is probably a grateful memory in these days. Unfortunately, the record of this experiment in its three stages of 2d. all the way, of 2d. and 3d., and of 1d., 2d., and 3d., is of no value as an index to its merit. Up to 1906, this tube was the only east and west tube in being. Its old-fashioned steam-driven rivals, the District and Metropolitan Railways, carried on what competition there was on the basis of a single fare of 3d. and a return fare of 4d. It was an unequal struggle. When in 1907 these railways had electrified, and the inequality in fare had been removed, there was a distribution of the east and west flowing passengers over the several routes, so that except for the one year of the Franco-British Exhibition the receipts of the Central London Railway, regardless of the fares charged, showed a continuous and slow decline right away to the war. There is no conclusion possible from the figures as to merits or demerits of flat versus differential fares' schemes for London. Anyway, the expansion of London is not attributable to any artificial forcing with a flat fare unless, by the way, the north-easterly out-thrust along the Great Eastern Railway, due to the absurdly cheap workmen's fares of 2d. return for all stations up to Enfield must be deemed such.

Another social factor that has a definite influence on a fares scheme is the density of the population. It would appear to need no proof that the denser the population the denser the traffic; but it is not quite so axiomatic. The denser the population above a certain point the poorer the individuals of which it is composed, and the less money available for rides. The upper working classes and the lower middle classes, if one may now employ such expressions without offence, are the most enthusiastic passengers. Every house occupied by them turns out two and sometimes three regular travellers. There is a margin of income with them available for pleasure and education. The population is less dense, but the greater part of it finds occasion and opportunity to move about. Blocks of flats are a gain to transport if an affliction to a town-planner. I wonder sometimes whether those who lay out those splendid estates on a liberal scale, with not more than 10 or 12 houses to the acre, quite realise that either the inhabitants must take more healthy walking exercise to and from the station, or else the general level of fares must be raised to compensate for the less dense traffic. The accepted distance which a passenger will walk to and from a station is half a mile, as a maximum. This gives a station an area of about 500 acres to draw upon. If the number of houses on an acre is halved, in compliance with the admirable modern standard, the passengers using the station will also be halved, and unless the area served can be enlarged, the fare must be enlarged. The garden city movement has its bearing on fares therefor.

As you ascend the scale of magnificence in housing and reach villadom, there is compensation of another sort in the first class fare. A first class fare is really extra consideration for a less dense traffic. That is why a first class carriage seats six to a third class ten, except on the Underground, where anomalously the accommodation is identical, but then first class accommodation is altogether an anomaly there. If passengers did not take first class tickets, the Underground would not retain first class carriages. It is the passengers' fault.

These brief notes are sufficient to show that social science or sociology is not without its share in the determination of fares. Study number three.

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Closely akin to sociology, but going a little deeper, is psychology. Improvements in transport permit mankind to gratify their instinct for gregariousness. America has just completed a fresh census. It shows that the population of the countryside has actually declined in the last intercensal period, and that all the increase that has occurred is in the overgrown cities and townships. There is no country life in America (at any rate in the Eastern States), there is not a village except in name, but smaller and still smaller towns. Urban conditions and habits prevail. Thus too in the continental state of Australia, more than half the population is concentrated in a little group of capital cities. London, as I have already stated, is reaching an urban aggregate of 10 millions of people. Is there any limit? All through the centuries there have been those who have foretold limits only to prove false prophets, so I am averse to joining their company.

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But it is safe to say if there is a limit it will be an economic limit, and the economic limit will be expressed in a fare. People will continue to be drawn into London until it is impossible for them to live on their income within its orbit comfortably. The fare between the centre and the outermost suburb will mark the breaking point. There is a curious piece of speculation for you to pursue.

The more interesting bearings of psychology relate to the individual. A good fare fixer must understand the animal, man. Man wants things cheap, and woman more so. If there is one thing they both want cheap it is their rides. I hardly know myself why this is except that being an intangible service, the moment the ride is over, they feel they have not got anything for their money. On this account the cost of travel must always be cheap in comparison with the general level of prices current. The price of a reel of cotton may soar from 2½d. to 10½d., and only provoke a grumble, but if the price of a ride goes from 3d. to 4d., the passenger casts about at once to see if he can cut the length of his ride by a single station distance, and so save the difference. Postage stamps, newspapers, matches may double in price, but the bit on the fare is always the last straw. This is a psychological puzzle.

Even more than he wants his fares cheap. It is to man's credit that he wants them equitable. He must be convinced that a scheme of fares represents an honest and proper distribution of the burden of payment over all sorts and conditions of passengers. If he lacks that assurance he revolts. The Underground has spent a great deal of both money and pains in advertising to the public with the one object of persuading all that its fares were right.

Nevertheless, a fair adjustment in the fare with the alteration in the general level of prices can be obtained. Even Charon learnt this, if Aristophanes is a credible witness. With a traffic absolutely guaranteed and continually increasing, when the two-obol standard had become general in Athens, as the professional juryman's fee, the out-of-work donation for festival days, soldier's pay and so forth, Charon had the effrontery to double the toll on the Styx ferry. It was sad for the dear departed whose relatives had not contributed more than the legal fare. When Dionysus and his slave Xanthias arrived in this predicament only one could get across and the unlucky slave was sent to run round. All the same it is an encouraging precedent.

Another psychological puzzle concerns the initial fare. 1½d. is not popular. I believe the public would pay 2d. just as readily. It is something in the looks of the thing. It is odd. It takes two coins but so does 2d. If two coins must be used, there is a sense of superiority in paying 2d. In New York, the trams charge a nickel or five cents, the motor omnibuses a dime or ten cents. Are the motor omnibuses prejudiced ? Not a whit. It is a mark of distinction, of dollardom, to ride on an omnibus. The economic man is easily beaten by the natural man.

There would be more 1½d. rides taken if there were a 1½d. coin. More 2d. rides likewise if there were a 2d. coin. Even the most conservative of governments will be compelled in the end to acknowledge the new scale of values which they help to maintain by a new range of coins. Judging from ancient petitions halfpennies and farthings were originally coined to pay for " the smaller measures of bread and beer, for God and for works of charity." They survived by reason of the intrigues of drapers with our womenfolk, and of the advent of the halfpenny press. Their day is done. I fancy their ill-repute sticks to them, and makes them unpopular in fares. Again, it is a piece of speculation for you to pursue to lighten your more serious studies.

So much for psychology. At bottom man must not think about his fare at all. Therein is the real art of fare fixing. If his fare is relatively cheap and equitable, if the coins do not bother him, man travels freely, never counting the cost. As someone else has said, " He is tethered to his home but he has a decent length of rope. The effect of higher fares is to shorten the rope and to that extent make him more a prisoner. Human beings are happy only under the illusion that they are free. Hence the extreme folly of making travel dear and difficult. It may irritate men into the discovery that they are still in chains." We must preserve the illusion, but it cannot be done at all cost. Just to travel must be the sole aim left to the passenger if it is possible. Study number four.

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I have left to the last economics, because everyone grants that this is a science concerned with fare-fixing. May be you will have had the common view and think it is the only one. At all events, you will be thoroughly taught in this and I need say little. What little I am going to say shall be about the so-called laws of supply and demand. Usually it is succinctly represented as a balancing process in which price is the makeweight. That cannot be a view acceptable to one engaged in transport. The task is to create demands because supply in transport almost always carries with it wasteful margins in partly filled carriages and partly loaded engines and partly occupied tracks. The process is not a balancing of supply and demand, so much as a balancing of demands at varying prices to give a maximum net result. From my arrival in London, in 1906, down to the opening of the war in 1914, I was engaged, in one post or another, in the execution of a single fare policy, that of gradually lowering fares so long as the volume of passengers to be carried would respond and yield a better final result. The railway passengers of the Underground Railways went up from 167 millions to 249 millions in the period, while, in spite of extensions adding to the length of journey, the average receipt per passenger went down from 1·86d. to 1·76d. That is the policy which has excited the Londoner—man, woman, and child—to take over 400 journeys on the average last year. The heaviest traffics that can be carried are the necessity of tube railways ; only through them can a reasonable journey price be attained. In the language of economics, it is a case of testing by progressive reduction in fares what is the marginal demand. The doctrine of charging " what the traffic will bear " is not founded on a simple supply and demand principle.

Curiously enough, I cannot trace a single instance of huckstering in transport. Even when the Thames watermen were at their bitterest conflict with the new hackney coachmen, both were governed by customary or prescribed fares.

As I have said, I cannot stay to expound economics ; it is too dangerous for an outsider. I might expound a heresy. I am merely going to risk two suggestions, and pass on. The first relates to the interaction of house rents and fares. It is said that the landlord may appropriate the benefit of a cheap fare by an enhanced rent. It seems to turn on the location of the house which, in the last resort, fixes the scale of rent. If the pressure falls on houses in the centre, the rents of those houses go up. (It may be high fares cause this pressure, but that is another story.) Then the rents of houses further and further out need only be modified in relation to the advance of the fare, until the value of the time spent on the journey seems material to the traveller, or the interest in the morning paper fails to last long enough. If, on the other hand, the pressure falls on houses at the fringe, the rents of those houses go up and up regardless of the fare (although it may be again that low fares cause this pressure), and the fare only serves to measure how much more up the rents of houses nearer the centre may be until the pressure has disappeared altogether, and the houses become empty and derelict. It is for you to explore every avenue of this topic.

The second suggestion relates to a supposed travel fund, much like the exploded wages fund theory. There is a certain proportion of the total income of the population, which can be spent, and will be spent, on travel. If the income is greater there is more travel, unless the fares are also greater in the same proportion. It helps as a theory to explain the creation of that marginal demand I just mentioned. Certainly there was a vast and abnormal growth in travel at the close of the war—the Underground railway traffics sprang from 300 to 400 millions in three years, which can only be attributed in part to the way in which fares lagged behind other prices until the recent revision. I fancy the extraordinary traffics which got us into severe disfavour for congestion were the consequence of our own mistake in not keeping our fares in harmony with, say, the cost of living. In confirmation, I can only state that the recent increase in fares relieved us of 10 per cent. of our passengers although our total rise in price, namely, 74 per cent., was less than half that of the cost of living, as officially calculated.

That is sufficient for economics. Study number five.

* * * * *

It is time to pick up the loose threads. We have looked at fare-fixing from many points of view. Of the Government desiring to control—that is law and administration. Of the service to be rendered—that is geography. Of the society to be served—that is sociology. Of the passenger to be carried—that is psychology. Of the undertaking embarked upon the enterprise—that is economics. I have redeemed the promise of my borrowed text and shown that transport is not so much a science in itself as the art of applying all sciences to a given problem. But I have said nothing of the point of view of the person fixing the fare.

I hope that you will now accept from me the statement that it can be neither by an arbitrator's arbitrariness ; nor by guesswork ; nor by simple addition and subtraction ; but it can only be by patient research and hard work with accounts and statistics. Accounts and statistics are the stubborn material with which a commercial man labours. They are the last study, but just as surely they are the first. They are dull and cumbersome until you appreciate their value, and you must bring to them what my Chairman, in his presidential address, described as imaginative treatment. Think for a moment how we use "expense" and "cost" as synonymous terms. But what is cost ? As I have already said, it must cover working expenses and outgoings of every sort, a full allowance for depreciation and renewals, and such a return on capital as will sustain the credit of the undertaking. All that is essential and until all that is met there is no profit in any true sense. And really, if you review urban transportation, in which I am chiefly interested, there is not a metropolitan city in the world where there has even been an adequate meeting

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of this cost over a span of years. Urban transportation has been consistently sold below cost. There has been too successful an effort to make travel relatively cheap. We are waking up to this fact to-day because we have reached a stage at which there is no further progress until we are fully solvent. Not that every good railwayman would not rather carry twice the number of passengers at half the fare for the same net result, if that were possible. He would willingly give good measure, pressed down and running over, if only the strap-hanger would not look at it in another way, and think the pressing down and running over is not good measure but scandalous overcrowding.

Now at length one of you might say to me, "All that you tell us is very fine but are you not working to a simple scale which you have advertised—a mile for 1½d., a mile and a half for 2d., two miles and a half for 3d., three miles and a half for 4d., five miles for 5d., six and a half miles for 6d., eight miles for 7d., ten miles for 8d., and so on?" And I must truthfully answer "Yes." But I want you to remember that behind the scale there has been a canvassing and recanvassing of all the several subjects that I have touched upon, among others; that the scale must represent a balance of revenue against expenditure and requirements and that this is a matter of anxious and careful estimate based on past experience. The simplest things may still contain the most thought. In fact a simple thing only becomes simple by thought. Further, I want you to remember that a scale is not applied with yardstick accuracy. So much so that there is infinite subtlety in the fixing of fares in relation to the natural or established traffic points such as street intersections or stations. And I can picture the rigid arithmetical mind indignant at this juncture at the thought of trick fares!

It needs courage to work to standards, just because it needs intelligence to fix proper standards and judgment to change them at the proper time. I trust it is not unfair for me to compare our Underground fares' scheme with that of the main line railways. Each was supplied with a Parliamentary standard. The one stuck to it, the other left it. No one in those remote days when the scheme was fashioned on the main line railways seems to have asked himself the question whether the scale was sound which charged a penny from, say, King's Cross to Holloway Road, and 15s. 8d. from King's Cross to York. It was quickly realised that such a scale did not meet the needs of the traffic for on top of the ordinary Parliamentary fares there came into being excursion fares, week-end fares, tourist fares, cheap return fares, market tickets, shopping tickets and what not. All these exceptional fares and tickets were attempts to mitigate the unscientific character of the Parliamentary scale and to prevent the stifling of the passenger traffic. On the Underground, the ordinary fares are supplemented by season tickets and by workmen's fares. All other special fares have been swept away, with the graduation of the scale of charge with the length of journey; and these two remaining classes should in all, and do in most cases, bear a definite relation to the ordinary fares with which they correspond. A workmen's return fare (and this is a privilege fare imposed for political reasons, political reasons, I may add, that are sound) is the single ordinary fare. The season ticket rate is nothing more than a discount on the ordinary fare for the regular rider, because of the bulk of his patronage and an instrument to develop the outer territories. Well, as I have said, the simplicity of the scheme is only gained by careful thought. It is not so easy as it looks.

And so I reach my closing thought. It is not mine, for I have stolen it from Professor Whitehead of your University. It sums up my address far more ably than I could myself. He says—

"Finally, there should grow the most austere of all mental qualities—I mean the sense for style. It is an æsthetic sense, based on admiration for the direct attainment of a foreseen end, simply and without waste. Style in art, style in literature, style in science, style in logic, style in practical execution have fundamentally the same æsthetic qualities, namely, attainment and restraint. . . Style, in its finest sense, is the last acquirement of the educated mind; it is also the most useful. It pervades the whole being. The administrator with a sense for style, hates waste; the engineer with a sense for style, economises his material; the artisan with a sense for style, prefers good work. (And may I not also say the commercial man with a sense for style, loves simplicity.) Style is the ultimate morality of mind."

London Tramway Extension.—Colonel J. W. Pringle, inspecting officer of the Ministry of Transport, on November 26 inspected the portion of the new Lee Green to Eltham tramways between High Road, Lee, and the entrance to Lyme Farm, Eltham Road, and it was opened for public traffic on November 29. The line is partly on the overhead and partly on the conduit system. A speed of 16 miles an hour is authorised over the greater part of the line, while for a distance of about half a mile a speed of 20 miles an hour has been sanctioned.

T.O.T. PHILHARMONIC SOCIETY.

Congratulations are due to the employees of the London Traffic Group for what they are accomplishing through the medium of the Tubes, Omnibuses and Tramways Philharmonic Society.

The organisation is a social lever for the creation of *esprit de corps* among the workers, 23,000 of whom are employed on the omnibuses, over 10,000 on the railways, and over 4,000 on the company's tramways. In the second place it is relieving the Metropolis of the reproach of an unfavourable comparison with small provincial centres in the organised study of vocal and instrumental music. Apart from Handel and Empire Choir Festivals, we doubt whether London can show any other musical record to approach what has been achieved by the T.O.T. Philharmonic Society in eighteen months. Its origin was due to the "Victory" concert and welcome home in the summer of 1919, in the Royal Albert Hall, to the ten thousand members of the staff returned from war service. For this purpose a choir of 400 voices, together with the bands of the Underground, Omnibus and Metropolitan Electric Tramways Companies, provided the major part of the programme. The same performers were responsible for the New Year entertainments given by the companies in 1920, and in January of that year they inaugurated the Philharmonic Society, of which Lord Ashfield became president. The bestowal of this honour was no ordinary compliment, for in the Albert Stanley Institute at Hammersmith for the Underground employees, London has one of its foremost instances of welfare work. That his efforts for the extension of such work are gratefully remembered was shown by the presentation to him on behalf of the associated companies on the occasion of his knighthood. Further evidence of appreciation was forthcoming when he presided in March and April last at the two inaugural concerts given under the auspices of the Philharmonic Society in the Central Hall, Westminster. Since then the Society has made noteworthy progress, as was revealed by the concert given on the evening of November 24 in the Royal Albert Hall. On this occasion the choir of 400 voices and military band of 110 were augmented by an orchestra of 60 performers, the combined forces having the good fortune to be under the baton of Mr. J A. Meale, one of London's foremost organists, while Mr. E. Stanley Roper presided at the organ. Mr. Meale's services did not end with the task of conducting, for he delighted the great audience with two organ selections. The other conductors for various items by choir and orchestra, combined or individually, were Messrs. E. Beech, A. Goodfellow, and S. Pinegar. Since their former appearances, the Society has somewhat strengthened the ranks of the male voices, and in the course of the present season we hope to announce that this task has been fully achieved. It requires more than ordinary devotion for traffic workers to give some of their spare hours to rehearsals, but in the earlier stages the work is facilitated by having the rehearsal centres spread over various districts. While the audience were assembling, Mr. A. E. Musgrove gave an organ recital, and the programme opened with a verse of the National Anthem by the massed forces. The band did full justice to Rossini's overture "Tancredi," Sullivan's "Mikado" selection, and to Chopin's "Polonaise." The same remark is applicable to the "Hymn to Music" (Dudley Buck); Wagner's march "Hail, Gift of Song" from "Tannhauser"; the opening chorus from Edward German's "Tom Jones," and to the Gavotte and Barcarolle from the latter work, in all of which items the choir and orchestra were heard. The Society's share of the programme concluded with a stirring rendering of Elgar's "Land of Hope and Glory" by the united sections, the audience joining in the refrain. The enjoyment of the audience and the members of the Society was enhanced by Mr. Meale's selection of outside talent. As vocalists there were Miss F. Mellors, Captain H. Heyner, and Mr. A. Heather, while Mr. M. Scott and Mr. W. Montagu gave humorous entertainments. It is to be hoped, however, that the musical director will not be too liberal in this respect. We can assure him that the audience will not be disappointed to hear more items from the choir, band, and orchestra. The opportunities of Londoners to enjoy choral and orchestral music are all too few. The Society's newly-formed operatic and dramatic section will make their appearance early next year, and this winter facilities are also being provided for dancing. Regret was felt that Lord Ashfield was prevented by indisposition from attending the concert. The deputy-chairmen and the directors of the companies were represented by Lord G. Hamilton, Viscount Knutsford, Lord Stuart of Wortley, Sir J. Devonshire, Sir A. Roger, Mr. H. A. Verney, Mr. Murray Griffith, Mr. L. Robinson, Mr. G. Watson, and Col. W. Dumble. Representatives also attended from all the railways running into London, while the officers of the Underground Group present were Messrs. H. E. Blain, Z. E. Knapp, G. J. Shave, F. Pick, C. J. Spencer, J. B. Lindsay, C. S. Larch, J. C. Mitchell, J. P. Thomas, J. Thornton, A. R. Cooper, W. A. Agnew, S. J. Webb, Capt. Rozier, A. V. Mason, and J. B. McKinnon.

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EMPLOYEES' WAGE DEMANDS.

REJECTION OF APPLICATION FOR INCREASE.

The result of the deliberations of the Municipal Tramway undertakings as to whether they should agree to the employees' wage demand, or refer it to arbitration, was announced on December 7 at a meeting of the Joint Industrial Council of the industry at the Ministry of Labour. On both points the decision was against the employees, who had asked for the matter to be referred to an arbitrator.

Attitude of the Employers.

Mr. J. Beckett, secretary of the Municipal Tramways Assocation, has made the following considered statement for the employers—

"The representatives of the local authorities informed the representatives of the employees of the result of the referendum which had been taken since the last meeting of the Council. It is important to remember that in almost every case the decision of the Tramways Committee had been ratified by the Town Council. This fact adds enormous weight to the resultant vote. It represents the considered view of the employers, who have looked at the question as sympathetically as they possibly could, having in view the resources at their disposal. A number of the undertakings are already on the rates to a material extent; in fact, the indications are that the tramways industry is in a state of increasing poverty, considered financially.

"As the secretary of the Municipal Tramways Association I had prepared a report upon the referendum, and, shortly stated, it was to this effect—that forty-five authorities voted against arbitration, chiefly on the ground that although they were not opposed to it they were now at the end of their financial tether and quite unable to meet any further demands. As against that number there were thirty-nine authorities voting in favour of arbitration. The principle of the association is that one authority possesses one vote, although they, of course, differ in magnitude. In these circumstances, there was no alternative for the municipalities but to intimate to the men's representatives that they must give effect to the decision of their constituents, and inform them they were unable to accede to their demands. The total number voting represents practically the whole of the municipalities in the kingdom, but only four authorities had not sent in their decision.

"There was very little discussion following the announcement. The men expressed their diasppointment with the result, and said there was obviously nothing further to consider at that stage. The conference, however, was characterised by extreme good temper on both sides.

"As a commercial enterprise the tramways industry must be self-supporting, and not be subsided by local taxation. With that view the National Council is in agreement, as also is the Ministry of Transport. The employers inquired whether the employees proposed to take any steps in the way of approaching the Ministry of Labour on the question, and the employees replied that they would consider the matter. The private companies took no part in the proceedings."

Statements by the Employees.

A statement issued by Mr. E. Bevin, on behalf of the employees' side of the Council, was as follows –

"At a previous conference the representatives of the privately-owned undertakings withdrew from the Council and took no part in the negotiations. It is significant that prior to the resumed meeting this morning the companies' representatives were in close consultation and attended the meeting of the municipal representatives. The public will draw their own deduction from what appears to the workpeople to be tactics on the part of the employers in trying to divide the consideration of the claim between the two interests.

"The municipal authorities' representatives announced that they had submitted the following questions—

(1) Whether the Corporations are willing that the application for an increase of wages should be referred to an independent court of arbitration.

(2) Whether in the event of the Corporations' answer to question 1 being in the negative, they are willing, providing that a majority of local authorities are in favour of referring the application to arbitration, to change their decision to one in the affirmative with an assurance that they would be prepared to give effect to whatever decision may result from such arbitration proceedings.

(3) Whether the Corporations wish to attach to their decision any conditions.

"As a result of the inquiry, we were informed that thirty-nine had voted for arbitration, and forty-five against, and the remainder had sent no return. The workpeople have adopted a pacific policy while having in view the whole time the securing of satisfaction for their members. The employers declined to give us the names of the Councils that refused to vote for arbitration, but we propose to obtain a complete return for publication. The executive of the Transport Workers' Federation will consider the whole question of future action."

Under the auspices of the National Vehicle Workers' Union, a Ways and Means Committee was subsequently formed to act in consultation with the Transport Workers' Executive to secure united action by the tramway workers of the kingdom. A manifesto recently urges that the men should meet at their various centres to consider their position and send in their resolutions. The secretary suggests that now that the war is over, conciliation, arbitration and all such methods are being thrown over by the employers, and the tramway workers are urged not to allow their standard of rights to be suppressed.

Reply of the Local Authorities.

Mr. J. Beckett, general secretary of the Municipal Tramways Association, in a reply to the manifesto of the Transport Workers' Federation, says—

"The manifesto seems to suggest that the employers have been actuated by a desire to force a strike. Nothing could be further from the desire of the employers. It is the public, acting through the municipal authority, who in turn act through the Tramways Committee, who are the employers. The public has manifested a singular hostility to any increase in fares in every part of the country. The exhibition that may be seen every week before the Tramway Rates Advisory Committee at the Ministry of Transport is both eloquent and instructive of the attitude of the man in the street towards increased fares.

"Many tramway authorities cannot earn any more money by any increase in fares whether or not they have the power to increase them. So far as these authorities are concerned, it is both dishonest and immoral to consent to arbitration when they know that in the event of the result being against them they are unable to foot the bill. One authority, in fact, pointed out in their reply that they agreed with the principle of arbitration, but the result might mean the closing down of the undertaking.

"It is not true to say that the municipalities' representatives have been acting in collaboration with the representatives of the companies' interests since their withdrawal from the negotiations. Nor is it true to say that their withdrawal was a 'tactical arrangement' on the part of the employers' side of the Council. If the votes of the companies' interests are added to the municipal vote against arbitration the figures will be—For arbitration, 39; against 108. It is now for the localities themselves to determine whether or not they are willing to change their opinion and their deliberate decisions."

Minister of Labour's Statement.

In the House of Commons, on December 8, Dr. Macnamara, Minister of Labour, replying to Mr. Wignall, said the tramwaymen's application had been discussed by the National Joint Industrial Council for the Tramway Industry, and, as far as he knew, was still before that body. He need hardly say that he would be ready to consider any representations which it might make. He added, in reply to further questions, that he would do all he could to bring the parties together again.

The Position of the Manchester Employees.

Some of the officials of the Manchester men, whom a representative of the *Manchester Guardian* interviewed, said they would not be surprised if on the wages question there was now a general break-away from the National Joint Industrial Council, so that the matter might be dealt with in the districts.

The Manchester men are waiting the answer of the National Executive of the United Vehicle Workers' Union to their decision to send a deputation to it asking its sanction of the local application. The Executive has not met since this decision was reached, so that it may be some days yet before the Manchester men can decide on their next step.

The English Electric Company have recently made an issue of £1,250,000 8 per cent. six-year secured notes at the price of £98 per cent. The notes are redeemable on January 1, 1927, at £103 per cent., or at the company's option after January 1, 1924. The yield, allowing for redemption, amounts to £8 16s. 6d. per cent. The notes are secured as a floating charge on the general assets of the company, subject to the debenture and banker's loan and overdraft. Excluding the goodwill, it is stated that the assets, including the net proceeds of the present issue, amount to £3,920,804, and thus covers the amount of the notes more than three times over. The average net profits for the past five years also cover the interest on the notes more than three times. The proceeds of the issue are being used to replace expenditure on the purchase of the Stafford works and for other purposes. It is stated that the company have on hand incomplete orders to the amount of over £5,000,000. The English Electric Company owns and operates the Dick, Kerr Works, Preston, the Ordnance Works, Coventry, the Phœnix Works, Bradford, Siemens Works, Stafford, and Willans Works, Rugby.

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CARS FOR LONDON COUNTY COUNCIL TRAMWAYS.

At the meeting of the London County Council on Tuesday, November 23, the proposals of the Highways Committee for the purchase of 125 new cars were adopted. The following are particulars of the tenders received—

TENDERS FOR 125 CAR BODIES.

	Class E1. per car.	Class E2. per car.
Hurst, Nelson and Company, Limited (for 50 bodies only)	£2,230	£2,430
Brush Electrical Engineering Company Limited...	£2,245	£2,455
English Electric Company, Limited ...	£2,555	£2,805

TENDERS FOR 125 SETS OF SWING BOLSTER TRUCKS.

	per set.
Hurst, Nelson and Company, Limited	£600
Brush Electrical Engineering Company, Limited ...	£630
Heenan and Froude, Limited	£836 10s.
Baldwin Locomotive Works	$4,380 (about £1,262)

TENDERS FOR 125 SETS OF ELECTRICAL EQUIPMENTS.

	per set
Metropolitan-Vickers Electrical Company, Limited	£1,300 10s.
English Electric Company, Limited	£1,306 10s.
British Thomson-Houston Company, Limited ...	£1,342 10s.

TENDER FOR MAGNETIC BRAKES FOR 125 CARS.

Metropolitan-Vickers Electrical Company, Limited ...	£21,875

The Highways Committee proposed that the tender of Hurst, Nelson and Company, Limited, should be accepted for 50 bodies of the class E1 type, at £2,230 each, and the tender of the Brush Electrical Engineering Company, Limited, for 75 car bodies at £2,245 each. In order to afford an opportunity of testing the motors offered by each company under running conditions, the committee proposed that the contract should be divided between two companies, and that 50 sets should be ordered from the Metropolitan-Vickers Electrical Company, Limited, at £1,300 10s. a set, and 75 sets from the English Electric Company, Limited, at £1,306 10s. a set. It was proposed the tender of Hurst, Nelson and Company, Limited, for swing bolster trucks at £600 a set should be accepted, and of the Metropolitan-Vickers Electrical Company, Limited, for magnetic brakes for all the cars.

The tenders contained provisos to the effect that the model conditions of contract of the Institution of Electrical Engineers shall, with the exception of the wages and labour clauses, be substituted for the conditions in the Council's form of contract where the two sets of conditions differ. Special conditions relating to payments under the contracts were made which differ both from those proposed by the Council and from those included in the model conditions. No tender contained a firm offer on the basis of fixed prices, so that it is impossible accurately to determine the ultimate cost of the cars until the contracts have been fulfilled. Each of the tenders provides for variations in cost, both upwards and downwards, the present day prices, as quoted, being taken as a datum line.

The cost for each of the 50 cars of the E1 existing standard type, complete, is estimated at £4,305 10s., and of the remaining 75 cars at £4,326 10s. each. The comparative cost of a similar type of car based upon orders placed in 1910 was £883 15s. The total expenditure involved amounts approximately to £548,000.

In accordance with deliveries promised, the first new car should be received in forty-two weeks and completed in forty-five weeks from the date of the order. Thereafter cars will be completed at the rate of six a week for the first hundred cars and three a week for the remaining twenty-five cars.

WORKMEN'S FARES.

GLASGOW CHEAP FARES ABOLISHED.

The cheap fares hitherto conceded by Glasgow Corporation to the labouring classes have now been abolished, and uniform rates are now charged on the city tramways.

The original Tramway Act contained a provision which granted lower fares for persons defined as artisans, mechanics, or daily labourers, the rates chargeable being a halfpenny per mile, with a minimum of a penny. On an application by the Corporation Committee to repeal this clause, the Ministry of Transport have issued an order granting the Tramways Department authority to charge artisans, mechanics, and daily labourers fares not exceeding the fares charged by the Corporation for the conveyance of ordinary passengers on June 1, 1920. This Order, unless previously revoked by the Minister of Transport, will have effect until February 15, 1923. Any further increase in fares made before this period of over two years expires will not affect the fares chargeable to workmen.

The abolition of the lower rates conceded to labourers was granted by the Ministry of Transport on the understanding that the Corporation shall not grant sums in relief of rates or otherwise to the Common Good until they shall have made reasonable provision for the proper repair, maintenance, and renewal of the entire undertaking.

DUNDEE'S APPLICATION.

A similar application by Dundee Corporation was made before the Advisory Committee of the Ministry of Transport by Convener Malcolm, Councillor John Reid, town clerk, and the tramways manager (Mr. W. T. Young).

Mr. Young said the present system was unfair and entailed loss of revenue. It very unfairly applied to only one section of the community, only to those who travelled before eight o'clock in the morning, and only to a number of workers who travelled between five and six in the evening. His staff had considerable difficulty in deciding who were and who were not workmen. The existence of these fares had caused a considerable amount of irritation among the general public, because they were being enjoyed by one class of workers, whose earnings were equal, and in many cases superior, to those of other classes, who did not come under the appellation of "workmen." The abolition would mean to the Corporation a saving of £240 per week, or £12,000 per annum. The estimated deficiency this year on the basis of the present fares was £10,000.

THE ADVERTISING EXHIBITION.

ADVANTAGES OF PUBLICITY ON TRAMWAY CARS.

At the very successful International Advertising Exhibition, which was held at the White City from November 29 to December 4, the value and importance of the publicity which is obtained through advertisements upon tramway cars was convincingly demonstrated by the Underground Railway group and by J. W. Courtenay, Limited. The former had an excellent position in the Court of Honour, and among other exhibits displayed small models of a London United tramcar and a London omnibus of the "K" type, provided with advertisements in the usual manner. A model tube train was also shown.

On the stand of J. W. Courtenay, Limited, a model tramway car, about one-fourth actual size, was shown. As this was made to rotate—showing the advertisements on both sides and ends of the car, while the interior was illuminated to display glazier advertisements—it attracted great attention from the enormous crowds that visited the exhibition. Posters were also shown indicating the extent of the business of the company, who are at present the contractors for over forty-five tramway undertakings. The company have the sole advertising rights on about 5,000 tramcars, besides a large number of omnibuses.

The exhibition included many other stands of much interest to those concerned with publicity and the production of artistic posters. The attendance throughout the week was very large, and in order to give business people an opportunity to examine the exhibits it was necessary on one day to limit the attendance by raising the admission fee from one shilling to five shillings.

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FINANCIAL REPORTS AND MEETINGS.

HALIFAX CORPORATION TRAMWAYS.—In a report covering the working of the Halifax Corporation tramways during the year ended March 31, 1920, to the Electricity and Tramways Committee, by the borough treasurer (Mr. G. H. Fry) a comparison is given of the results of the past six years' working, three of which are given below—

Expenditure.	1915	1919	1920
	£	£	£
Traffic expenses	29,207	47,636	72,019
General expenses	3,757	5,569	7,268
Rates...	4,120	4,716	5,375
General repairs and maintenance expenses...	13,529	24,740	44,708
Power expenses	21,597	26,756	31,784
Sinking fund...	12,106	13,391	12,758
Interest	10,424	11,772	13,086
Parliamentary expenses	925	...	...
Parcels traffic	1,294	2 340	2,578
Income tax	...	3,596	1,122
	96,959	140,516	190,698
	d.	d.	d.
Per car mile	9·987	18·222	21·536
	£	£	£
Revenue	113,170	151,283	191,334
	d.	d.	d.
Per car mile	11·657	19·619	21·703
	£	£	£
Net profit on year	16,211	10,767	636
	d.	d.	d.
Per car mile	1·670	1·397	·073

The expenditure for the year showed an increase of £50,181, or 35·71 per cent., while the income has been increased by £40,051, or 26·41 per cent. Of the increase under expenditure £28,603 is attributable to salaries and wages. The following statistical information gives a

COMPARISON FOR TEN YEARS DATING BACK TO 1910-11.

	Miles run.	Passengers.	Receipts per mile.	Average fare.	Total cost per mile.	Profit per mile.
			d.	d.	d.	d.
1910-11	1,909,397	17,067,865	11·64	1·26	10·19	1·45
1911-12	2,102,757	18,749,456	11·63	1·26	9·57	2·06
1912-13	2,152,391	19,456,923	11·82	1·27	10·41	1·41
1913-14	2,242,086	20,276,077	11·74	1·26	10·28	1·46
1914-15	2,330,104	20,707,071	11·66	1·27	9·99	1·67
1915-16	2,195,980	21,024,003	12·41	1·26	10·33	2·08
1916-17	2,048,772	21,180,584	13·48	1·27	11·71	1·77
1917-18	1,864,357	22,822,341	16·65	1·33	14·49	2·16
1918-19	1,850,513	24,516,973	19·43	1·43	18·03	1·40
1919-20	2,115,734	26,295,770	21·46	1·68	21·30	·17

MONTREAL TRAMWAYS COMPANY.—The annual report of the Montreal Tramways Company, submitted at the annual meeting of shareholders on September 28, states that the gross revenue for the year amounted to 2,375,579 dollars, and expenses to 1,923,071 dollars, leaving a net income of 452,508 dollars, from which had been declared three quarterly dividends of 2½ per cent., amounting to 290,550 dollars. In addition to these quarterly dividends, the Company had paid the dividends in arrear for three quarters of 1918, leaving three quarterly dividends still in arrear. The balance at the credit of the general surplus account is shown as 941,175 dollars.

BRISBANE TRAMWAYS.—The Queensland Government having failed to exercise its right to purchase the Brisbane tramways, the Brisbane Electric Tramways Investment Company have suggested that holders of its 4½ per cent. first debenture stock should consent to the postponement of payment for three years, while the question is being settled with the Government as to the purchase of the undertaking. It is proposed that interest shall be raised from 4½ per cent. to 8 per cent. for the period and that 2 per cent. extra shall be paid if the debentures are redeemed within three years. Under the original terms of the concession the Municipality had the right to acquire the tramways, but the Queensland Government introduced a Bill transferring that right to itself, the company having the option of accepting the purchase money in cash or 4½ per cent. twenty-one year Government debentures.

AYR CORPORATION tramways department shows a total revenue for the year ended May 25, 1920, of £36,134, and working expenditure of £29,269, leaving a balance of £6,865. After payment of interest and contribution to sinking fund, etc., there is a balance of £5,124, which has been appropriated to the depreciation and reserve account. The total revenue per car mile was 18·91d., and the working expenses 15·32d. The percentage of working expenses to receipts was 80 per cent. The average fare per passenger was 1·53d. The number of passengers carried aggregated 5,489,522.

LEEDS CITY TRAMWAYS DEFICIT.—The following statement shows the receipts and expenditure of the Leeds City tramways for the period from October 1 to 27.

Oct. 1—Oct. 27, 1920.	Totals.	Per car mile.
Traffic and sundry revenue ...	£75,595	24·25d.
Expenditure	£76,640	24·58d.
Deficit ...	£1,045	·33d.

Average deficit per day, £39.

During the corresponding period of the previous year the traffic and sundry revenue amounted to £64,586, showing an increase for the current seven months of £11,009. The number of tickets issued as compared with the corresponding period shows an increase of 2·95 per cent.

For the first seven months of the current financial year (April 1 to October 27) the results are as follows—

April 1 to Oct. 27, 1920.	Aggregate	Per car mile.
Traffic and sundry revenue ...	£581,077	23·62d.
Expenditure	£606,487	24·65d.
Deficit ...	£25,410	1·03d.

Average deficit per day, £121.

The receipts for the corresponding period of last year were £521,935 thus showing an increase of £59,142 for the seven months.

BRADFORD CORPORATION TRAMWAYS.—The report of the general manager, Mr. R. H. Wilkinson, states that during the year ended March 31, 1920, the service was improved by the addition of new rolling stock, but more cars are required to deal with the traffic efficiently. The following statement shows in a condensed form the income and expenditure and the disposal of the gross profit as detailed in the accounts.

	1920	1919
Traffic revenue	£581,151 16 9	£471,940 0 6
Sundry revenue	27,839 1 5	22,305 11 10
Total revenue	608,990 18 2	494,245 12 4
Working expenses	501,534 8 0	375,074 0 10
Gross profit	£107,456 10 2	£119,171 11 6
Against which is charged—		
Interest on capital	17,452 1 3	17,592 1 0
Less bank interest, rents, etc.	5,272 15 3	4,101 12 6
Total	12,179 6 0	13,490 8 6
Income tax	19,545 2 0	14,452 0 0
Rent of leased lines	3,177 12 3	3,349 8 3
Sinking fund	27,716 17 6	27,053 13 8
Travelling of deaf and dumb ...	9 5 9	6 8 3
Reserve and renewals fund ...	14,828 6 8	60,819 12 10
	£77,456 10 2	£119,171 11 6
To relief of rates	£30,000 0 0	

The traffic revenue, excluding the railless system, amounted to £562,675, an increase of £105,857 over the previous year. The total revenue from the railless system was £18,477, or 11·625d. per car mile, an increase of £3,355 or 1·075d. per car mile. The increase in operating expenses is, however, £7,734. The car mileage (excluding the railless system) amounted to 5,266,910, an increase of 341,088 or 6·92 per cent., and the revenue increased 23 per cent., raising the receipts per car mile from 22·257d. to 25·645d. The expenditure shows increases in general expenses, £5,500; rates and taxes, £3,412; general repairs and maintenance, £48,580; cost of permanent way repairs, £11,044, and repairs to cars, £35,301, and other items make a net increase of £113,142. The cost for current has increased £16,601, or ·582 per car mile, owing to the rate charged for electricity having been advanced a further 30 per cent. The total number of passengers carried (including the railless system) was 86,469,014, an increase of 10,049,555, or 13·15 per cent., and the average number of journeys per head of population served increased from 207 to 233. Twenty new cars were constructed and put into service to replace others that were purchased in 1902. Of the twenty-six cars, complete with new trucks, motors and equipment, ordered from the English Electric Company, Limited, twenty were delivered. In addition, twenty-five trucks ordered in 1915 have been put into service, with D.K. motors and equipment supplied by the English Electric Company, Limited. Mr. Wilkinson states that the new motors are of ample capacity and are equal to all demands made upon them.

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TRAMWAY CHAIRMEN FOR 1920-21.

Municipal Tramways Committees have now been appointed for the ensuing year, and we append a list of the chairmen and vice-chairmen. New appointments are indicated by an asterisk.

TOWN.	CHAIRMAN.	VICE-CHAIRMAN.
Aberdare	Coun. E. S onelake ...	
Aberdeen	Coun. D. W. Beaton	
Accrington... ...	Ald. T. E. Higham ...	Coun. F. Lord
Ashton-under-Lyne	Ald. R. S. Oldham ...	Ald. C. H. Waterhouse
Ayr	*Bailie J. Smith	Coun. T. Murray
Barking	Coun. A. Whiting ...	
Belfast	Coun. W. G. Turner ...	*Coun. D. Anderson
Bexley	*Coun. W. H. Monk ...	
Birkenhead ...	Coun H. Halsall ...	*Ald. S. Vaughan
Birmingham ...	Coun. W. E. Lee ...	
Blackburn	Coun. C. Higham ...	Ald. W. Thompson
Blackpool	Coun. H. Brooks ...	Coun. T. G. Lumb
Bolton	Coun. J. R. Horrocks	Coun. P. Higson
Bournemouth ...	*Coun. J. Wilson ...	*Coun. W. H. Ridout
Bradford	Ald. E. Priestley ...	Coun. I. F. Akeroyd
Brighton	*Ald. J. Lintott	
Burnley	Coun. E. Heap	Coun. D. D. Irving
Burton-upon-Trent	Ald. J. S. Rowland ...	Ald. T. E. Lowe
Bury	Ald. T. S. Collinge ...	Coun. H. Hargreaves
Cardiff	*Coun. S. O. Jenkins ...	*Coun. W. H. Renwick.
Chester	Ald. J. Jones	Coun. A. S. Dutton
Chesterfield ...	*Coun. P. M. Robinson	*Ald. Sir E. Shentall
Colchester	*Coun. G. F. Wright ...	*Coun. W. Chopping
Colne	*Coun. J. Thompson ...	
Coventry	*Coun. French	*Coun. Bates
Croydon	Coun. A. A. Thomson	Ald. G. J. Allen
Darlington ...	Ald. Sir C. W. Starmer	
Derby	Coun. W. Eaton ...	
Doncaster	Ald. S. Balmforth ...	
Dover	Coun. Barwick	*Coun. Thomas
Dundee	Coun. A. Malcolm ...	
East Ham ...	*Ald. Oakes	*Coun. Newling
Eccles	Coun. Alexander ...	Ald. Pearson
Edinburgh ...	Coun. W. R. Sleigh ...	
Erith	*Coun. W. F. B. Howell	
Exeter	Coun. F. G. Towill ...	Coun. F. Chick
Farnworth ...	*Coun. Barnes	*Coun. R. H. Cunliffe
Glasgow	*Bailie M'Whirr	*Bailie Laing
Gloucester	Coun. J. O. Roberts (Mayo) ...	Coun. W. Colwell
Great Yarmouth	Ald. D. McCowan ...	
Halifax	*Ald. C. F. Spencer ...	Ald. A. Broadley
Haslingden ...	*Coun. Haworth	*Ald. Russell
Heywood	Ald. J. Ashworth ...	Ald. T. Popple
Huddersfield ...	Coun. E. H. Sellers ...	Coun. T. Canby
Hull	Coun. A. D. Willoughby	*Coun. C. P. Sherwood
Ilford	*Coun. G. R. Davey ...	Coun. H. L. Crofts
Ipswich	Coun. E. C. Ransome	*Coun. W. Reavell
Keighley	*Coun. J. Crabtree ...	
Kilmarnock ...	*Coun. Dunlop	
Kirkcaldy	Coun. G. Fergusson ...	
Lancaster	Coun. T. Wilkinson ... (Mayor)	
Leeds	Ald. R. A. Smithson...	Ald. H. Brown
Leicester	Ald. S. Flint	Ald. G. Banton
Leyton	Coun. C. W. Daines ...	
Lincoln	Ald. W. S. White ...	
Liverpool	Coun. F. C. Wilson ...	Ald. F. Smith
Lowestoft	Coun. F. Spashett ...	
Maidstone	Ald. D. T. J. Lyle ...	Coun. Armstrong
Manchester ...	Ald. J. Bowes	Ald. A. W. Chapman
Middlesbrough ...	Coun. E. Turner ...	Ald. J. Calvert
Nelson	Ald. W. F. Cooke ...	
Newcastle-on-Tyne	Ald. R. Mayne	Coun. Sir A. M. Sutherland
Newport (Mon.)	Coun. J. Moxon ...	Ald. F. Phillips
Northampton ...	*Ald. James	*Coun. Wareing
Nottingham ...	*Coun. Clarkson	*Ald. Turney
Oldham	Coun. J. K. Cheetham	Ald. W. Stanbury
Perth	Coun. A. W. Fisher ...	
Plymouth	Ald. Sir T. Baker ...	Coun. J. Moon
Pontypridd ...	Coun. M. L. Jones ...	
Portsmouth ...	Coun. J. Timpson ... (Mayor)	
Preston	Ald. T. Parkinson ...	Ald. J. Ormrod
Rawtenstall ...	Coun. H. Crabtree ...	Coun. J. W. Stansfield
Reading	Ald. C. G. Field... ...	
Rochdale	Ald. J. Taylor	
Rotherham ...	Ald. G. Gummer ...	Coun. G. E. Caine
St. Annes	Coun. A. E. H. Lee ...	
St. Helens	Coun. A. Rudd	Coun. T. Abbott
Salford	Ald. H. Linsley	Ald. W. H. Barrett
Sheffield	Ald. Sir Wm. Clegg ...	Ald. W. C. Fenton
Southampton ...	Ald. F. A. Dunsford...	
Southend-on-Sea	Coun. C. Radford ...	
Southport	*Ald. Richardson ...	*Coun. Lloyd
South Shields ...	Ald. W. G. Wylie ...	Ald. J. G. Winskill
Stalybridge ...	*Ald. R. Wood	*Ald. J. E. Rhodes
Stockport	Coun. T. W. Potts ...	Coun. W. Merrison
Sunderland ...	Ald. G. New	Ald. W. Walker
Swindon	Ald. G. H. Stevens ...	*Coun. Noble
Wallasey	Coun. F. E. Howse ...	Coun. H. W. Griffin
Walsall	Ald. J. Cope	Ald. J. Williams
Warrington ...	Ald. Sir P. Peacock ...	Ald. J. Wilkinson
West Bromwich	Ald. A. G. Turley ...	*Coun. Wheatley
West Ham ...	Coun. G. Croot	
West Hartlepool	Ald. Martin	Coun. Turnbull
Wigan	Coun. A. Guest	Coun. J. Walkden
Wolverhampton	*Ald. S. Craddock ...	
York	*Coun. W. H. Sessions	*Ald. C. W. Shipley

PERSONAL.

Sir George M. Chamberlin has been appointed a director of the Norwich Electric Tramway Company.

Mr. G. W. Partridge has been appointed general manager of the London Electric Supply Corporation, Limited.

Sir Charles Starmer has been re-elected chairman of Darlington Corporation Electricity and Light Railways Committee.

The Right Hon. Lord Sydenham of Coombe has been elected president of the British Empire Producers' Association.

Mr. L. C. F. Bellamy, general manager of St. Helens Corporation tramways, has been granted an increase in salary of £75, to £650.

Sir William Clegg has been reappointed chairman and **Alderman W. C. Fenton** vice-chairman of Sheffield Corporation Tramways Committee.

Sir John F. C. Snell has been appointed a member of the Advisory Council to the Committee of the Privy Council for scientific and industrial research.

Mr. J. H. Rider has been appointed arbitrator between Torquay Corporation and the local tramway company as to the charge for energy for traction purposes.

Councillor Clarkson has been appointed chairman of the Nottingham Corporation Tramways Committee, and **Alderman Turney** has been appointed vice-chairman.

Mr. Samuel Butler, permanent way engineer of St. Annes-on-the-Sea Council Tramways, has been appointed permanent way superintendent to the Bury Corporation Tramways.

Mr. Robert Finnegan, a well-known contractor, who laid electric tramways at Great Crosby, Liverpool, and many other parts of the country, has died at his home at Northampton, at the age of 66.

Mr. C. C. Macrae, deputy chairman of the London, Brighton and South Coast Railway, has been elected chairman of the Board in succession to the late Earl of Bessborough. **Lord Henry Nevill** has been elected deputy-chairman.

Mr. J. A. Bromley, assistant rolling stock superintendent of Leeds City Tramways, has been appointed general manager of the Keighley Corporation Tramways and trolley vehicles undertaking. There were 52 candidates for the position.

Mr. Arthur Watson, general manager, Lancashire and Yorkshire Railway, has been appointed general manager of the London and North-Western Railway. Mr. Watson is to continue as general manager of the Lancashire and Yorkshire Railway.

Mr. A. Hugh Seabrook, M.I.M.E., M.I.E.E., has begun private consulting practice at 11, Queen Victoria Street, E.C.4. He proposes to specialise in fuel economy in heat and power plant, and to advise on electric power, heat and lighting installations.

Alderman R. A. Smithson has again been re-elected chairman of the Leeds Corporation Tramways Committee. He was first appointed chairman of the committee in November, 1898, and has held that position ever since, with the exception of three years (1910 to 1913) as chairman of the Parliamentary Committee.

Mr. F. C. Wilson, on his re-election as chairman of the Liverpool Tramways Electric Power and Lighting Company, said that the financial position of the undertaking required serious attention, as the cost of labour had increased by 126 per cent. and materials by 370, while revenue had only increased 104 per cent. The tramway fares would probably have to be increased again.

Mr. Richard Hoggard, traffic superintendent of Wigan Corporation tramways, has been appointed traffic manager of the City of Lincoln tramways and motor omnibus department, and hopes to take up his new duties early in the New Year. Previous to his appointment at Wigan in February last, Mr. Hoggard was for nineteen years on the staff of the Sheffield Corporation.

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TRAMWAY AND LIGHT RAILWAY NOTES.

BARROW-IN-FURNESS

A Car Driver Faints.

As a Barrow car was approaching Furness Abbey terminus the motorman fainted and fell on the platform. The car proceeded uncontrolled to the terminus, and after going fifty yards further dashed into a wall. There were no passengers in the car. The driver was picked up insensible, but practically unhurt, and the conductor escaped injury.

BRADFORD.

The Parcels Delivery Service.

Although the year ended March 31 constituted a record in the number of parcels carried by the Corporation parcels delivery service, there was a loss of £2,412. This has been caused by the very large amount paid to the messengers in wages and bonus, and the fact that the parcel rates have for some time been the maximum permitted by law. Until new powers are obtained to advance the charges, the department cannot pay its way. The number of parcels carried in the course of the year was 713,073; the gross income was £16,094, the income from parcels being £12,143. The gross expenditure was £18,506, of which £11,116 represented wages.

BRIGHTON.

Trolley Standard Mishap—Increase in Fares.

The Town Council have adopted the report of the Tramways Committee, recommending an increase in fares. While the old fares will be doubled, the 1½d. fare will be increased to 2½d. The committee anticipate that the change will add £10,000 to the annual revenue. It will not, however, be sufficient to meet all the deficit, but the surplus is to fall on the reserve and not immediately on the ratepayers. On November 29, a tramcar came to a sudden stop, and the motorman found the conductor on the top deck unconscious and bleeding from the head. When he came to, the conductor stated that he was attending to the trolley when the wheel became entangled with the wires and wrenched the standard out of position. A live wire which had broken away had to be replaced before traffic could be resumed.

BOLTON.

Developments Under Consideration.

Bolton Tramways Committee have appointed a sub-committee consisting of the chairman, the vice-chairman, Aldermen Hinton and Russell, and Councillors Cheadle, Heywood and J. Taylor to take into consideration the question of future developments of the tramways.

EDINBURGH.

Cable Cars Give Place to Omnibuses.

The worn out cable car system on the Mound-Tollcross route in Edinburgh was discontinued on October 30. On the following day the first motor omnibus, an A.E.C. single-deck vehicle, was run. Four other omnibuses added to the service, three in the forenoon and four in the afternoon, are filling the place of the five cable cars, the journey occupying nine instead of twelve minutes.

FALKIRK.

The Tramways Bill.

The Falkirk and District Tramways Order Confirmation Bill has been read a third time in the House of Commons.

GLASGOW.

Women Tramway Workers' Wages—Car Thieves.

The town clerk of Glasgow reports that the Judge of Appeal has dismissed a complaint under the Wages (Temporary Regulation) Act, 1918, made by the Amalgamated Association of Tramway and Vehicle Workers on behalf of female workers in the tramways department. The Association appealed against a decision of the Local Munitions Tribunal, which was to the effect that the Corporation are paying not less than the prescribed or substituted rates, and are not in contravention of the Act of 1918. Sentences of twelve and six months hard labour were recently passed at the Sheriff's Court, on two men for thefts from cars. It was stated that the procedure of the thieves was to watch messenger boys and girls. If a parcel was left on the platform, the prisoners boarded the car and, if they got an opportunity, made off with the parcel. In this case the men were caught in the act, and the goods, to the value of £100, were recovered.

GREENOCK.

The Tramways not to be Purchased.

Greenock Corporation has decided not to reappoint the Tramway Sub-Committee which was constituted to consider the advisability of purchasing the system at present controlled by a private company. The company will, therefore, remain in possession till 1928. The recent November elections were fought on the municipalisation issue.

HALIFAX.

Runaway Car Fatality.

A Halifax tramway car travelling from Sowerby Bridge on November 23, got out of control near King Street, Halifax, where there is a moderate gradient. The track was very greasy owing to foggy weather. The car collided with a motor wagon and pushed it round a sharp curve into Bull Green. A woman who was crossing the road at this point was knocked down and carried a short distance under the car. She was pinned underneath nearly twenty minutes before she could be extricated, jacks having to be obtained to raise the car. She died while being taken to the infirmary.

KEIGHLEY.

Overhead Transmission Line for Quarries and Traction.

Keighley Town Council decided on November 30 to construct a transmission line (mainly overhead) from the nearest high tension main in the borough to Eastburn quarries, for the purpose of a general supply of electricity on the extra high tension system to Steeton-with-Eastburn and Sutton, and for boosting up the voltage on the trackless trolley lines, at an estimated cost of £3,000.

LIVERPOOL.

First Class Fares.

Protests have lately been raised against the continuance of first-class fares on the tramways. The *Post* alleges that under the pressure of circumstances the system of first-class fares has for the present almost broken down, and at certain times in the day everything goes but the charge. Our contemporary thinks that if the system cannot be restored upon the original conditions, which included the guarantee of a seat for the extra payment and the absence of the strap-hanging inconvenience, it should be scrapped.

LONDON.

Membership of the Municipal Association—Fares on the Company Tramways—Opening of an Extension—L.C.C. Parliamentary Bill.

The London County Council on December 1 agreed to continue their membership of the Municipal Tramways Association, the subscription being £105, in accordance with the amended Articles of Association. As a result of the report of the Tramway Charges Advisory Committee, which held an inquiry into the existing tramway fares, orders have been issued placing the London United Tramways, the Metropolitan and the South Metropolitan Tramways on the same footing as regards charging powers. A few of the fare stages on the London United Tramways which were unusually long are being reduced, and the workmen's fares are being increased. The new order provides that no material alteration is to be made in the fare stages on any of these three lines without prior consultation with the local authorities concerned. At the outbreak of the war, the L.C.C. tramways department was about to put in hand a 1½ miles extension to Eltham of the tramways from the Victoria Embankment to Lewisham and Lee Green. Greatly to the detriment of munition workers at Woolwich Arsenal, the Government forbade the work being carried out. If the lines had been so extended, a junction would have been effected with the Eltham-Woolwich track, which was constructed before the war, and proved of great utility when the Government had to develop at Eltham a housing estate for the accommodation of Arsenal workmen. The short-sightedness of "the powers that be" was made manifest after 1915, when demand for munitions led to the hurried widening of the Embankment-Woolwich line where single track existed, and claims were made upon the Ministry of Munitions for a contribution. It was not until last summer that the County Council were able to let a contract for the Eltham extension, which on November 29 was opened as far as Eltham Hill. The remaining short link to the line from Woolwich will be completed before the end of the year.

MANCHESTER.

Unrest in Regard to Fares.

Alderman Bowes, chairman of the Tramways Committee, stated at the Council meeting that the committee had endeavoured to allocate the tramway fares at 1½ miles for a penny, and they were prepared to deal with any anomalies. Councillor W. Davies, a member of the Tramways Committee, alleged that there was great unrest in regard to fares. A Committee is sitting to inquire into the matter.

NEWCASTLE-ON-TYNE.

Special Fare by Late Car—Extension to Gosforth.

A special late car is being run at Newcastle on the Scotswood route and leaves the Central Railway station a few minutes after the arrival of the last train from London, due in the city at 11.25. A special fare of 6d. is charged. The City Council, on December 1, adopted a recommendation of the Tramways Committee for the construction of an extension in Gosforth Park. The line will be double track, about a mile and one-third in length, and the estimated cost is £50,000. Alderman R. Mayne, the chairman of the committee,

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said that the line would give the citizens enjoyable afternoon and evening rides from the city, up North Road through the Park, and home by Benton. The line would also provide a connection that would be most useful in handling race traffic. The Tramways Committee (said Alderman Mayne) had never promoted any extension that had not proved successful.

SHEFFIELD.

WATER BURST TEARS UP TRAMWAY.

A portion of the Sheffield tramway track was torn up on November 4 by the bursting of a water main. A volume of water was thrown 35 ft. into the air.

SUNDERLAND.

THROUGH RUNNING TO BE INTRODUCED.

The Tramways Committee have reaffirmed their approval of the principle of through running by the cars of the Sunderland District Tramways Company over the Corporation tracks from Grangetown to the gas office. The necessary arrangements have been referred to a sub-committee, who, it is hoped, will soon deal definitely with the matter.

WALSALL.

HIGHER FARES.

To avert a threatened deficit, higher fares have been adopted for the tramways by the Town Council. Alderman Cope, chairman of the committee, said it was estimated that there would be a loss of £17,000 a year if the fares were not increased.

WEST HAM.

CONDUCTOR'S FRAUD.

Arthur Clarke, a tramcar conductor, employed for twelve years by West Ham Corporation, was sentenced to one month's hard labour for embezzling money belonging to the corporation. It was stated that but for the discovery that the accused was selling tickets issued to another conductor, the latter would have been called upon to make good the loss.

CONTRACTS AND ORDERS.

Hull City Engineer has been empowered to negotiate for the purchase of a charging set for the electric vehicles.

The Dennis Motor Fire Engine recently delivered to the York fire brigade has been thoroughly tested and proved satisfactory.

Manchester Corporation have accepted the tender of Messrs. Newton and Bennet for the supply of a 34-cwt. Vulcan petrol lorry.

J. W. Courtenay, Limited, have been appointed the sole advertising contractors for the Yorkshire (West Riding) Electric Tramways Company, Limited.

The Scottish Electric Vehicle Company, Limited, have an order from Glasgow Corporation Cleansing Committee for four chassis for electric tipping wagons.

Walsall Tramways Committee report that the contract price for the car bodies now being made for the Corporation has been increased consequent upon the increase in railway rates.

Hammersmith Council have received the sanction of the Ministry of Transport for a loan of £2,832 for the purchase of two 5-ton steam wagons for street watering and general haulage purposes.

Shanghai Municipal Council have placed an order for one 20,000-KW. turbo-generator set with the Metropolitan-Vickers Electrical Company, Limited, and for a similar machine with C. A. Parsons and Company, Limited.

Birkenhead Corporation have accepted the tender of the British Thomson-Houston Company, Limited, for rotary converter plant at £4,660, and of W. T. Henley's Telegraph Works Company, Limited, for h.t. mains at £8,832 16s.

The tender of the **Anglo-American Oil Company** for constructing an underground tank with pumping apparatus for storing 2,000 gallons of benzol has been accepted by Rotherham Corporation Tramways Committee. The price is £295.

Walsall Tramways Committee have authorised the manager to buy in the open market for the present the stores required for the department. When the market is more favourable the question of annual contracts will again be considered.

Ilford Tramways Committee have accepted the tender of Walter Scott, Limited, Leeds Steel Works, for 50 tons of rails, B.S.S. No. 3, at £29 per ton, and of Hadfields, Limited, for 60 pairs rolled steel fishplates, with bolts, B.S.S. No. 3, at 33s. 6d. per pair and 100 mild steel tie-bars at 8s. each.

Hammersmith's New Electrics.—Hammersmith Borough Council report delivery of two of the six electric vehicles ordered from Messrs. Mossay and Company. These are now in use and working satisfactorily. Early delivery of the remaining four vehicles is promised. Meantime arrangements for charging the vehicles have been made at the electricity works pending permanent arrangements in this connection.

PATENT LIST

Abstracted for "The Tramway and Railway World" from the Official Journal of Patents.

***** If the inventions have been communicated the names of the communicators are given in italics.**

APPLICATIONS FOR LETTERS PATENT.

The number of the patent is given in brackets.

Dynamo and switchboard for motor vehicles (30,569)—H. T. Collier, H. B. Elcock and J. J. Milne.
Motor vehicles (30,330)—J. R. Garner, Lancashire Ordnance Accessories Company and A. A. Remington.
Tramcars (30,690)—S. Geddis.
Motor vehicles (30,247)—R. H. Hassler, Inc.
Automatic brake for vehicles (30,315)—P. A. Holliday.
Auxiliary spring device for motor vehicles (30,472)—H. S. Nowell.
Radiators for motor vehicles (30,521)—S. Nuttall.
Direction indicators for road vehicles (30,326)—H. Oxley.
Engine bonnets and bodies of motor vehicles (30,195)—A. T. Sadler.
Bearings for axle boxes of tramcars (30,344)—C. H. Taylor.
Trolley heads (30,747)—S. A. Thompson.
Power transmission mechanism of motor vehicles (30,570)—E. Walpole.
Indicators for vehicles (30,846)—A. Bicheno, L. Bicheno and A. M. Kemp-Gee.
Direction indicator (31,196)—L. J. Bicker and C. R. Thickpenny.
Means for mounting and securing removable pillars for bodywork of motor vehicles, etc. (31,274)—Bristol Wagon and Carriage Works Company, G. Condick and H. Gilpin.
Motor vehicle direction indicator (30,864)—F. W. Brunker.
Combined chair and fishplate for light railways (31,383)—A. M. Edwards, T. O. Rees and T. Thomas.
Steering mechanism of motor vehicles (30,888)—A. A. Govan.
Friction gear for motor vehicles (31,408)—L. H. Greenwood.
Trolley bases (30,959)—A. W. Ham.
Motor vehicles (31,214)—L. C. Humfrey and E. E. Sutton.
Prevention of fouling of overhead gear by trolley head (30,890)—M. Huxley.
Spring suspension devices for motor vehicles (31,080)—A. J. McDonagh.
Motor lorries (30,916)—T. W. McDonagh.
Extension rail (30,881)—T. Quinn.
Springs for motor vehicles (31,132 and 31,133)—W. Shackleton and Sheffield Simplex, Limited.
Fluid fuel containers and supply devices for motor vehicles (31,134)—W. Shackleton and Sheffield Simplex, Limited.
Friction gear for motor vehicles (31,408)—J. A. Spencer.
Route indicator (31,232)—M. J. Wallage.
Brake for motor vehicles (31,277)—F. Winterbottom.
Collectors for electric tramway vehicles (31,730)—A. C. Baker, H. Cross and H. M. Dudgeon.
Braking systems for motor vehicles (32,015)—Bentley Motors, Limited, and W. O. Bentley.
Means for propelling and steering vehicles (32,002)—W. H. Bingham, C. A. Holt and C. S. Holt.
Emergency brake for motor vehicles (31,724)—W. Birtwistle.
Steering gear (31,719)—H. G. Booth.
Trolley heads (32,003)—R. J. Danson.
Non-skidding device for motor vehicles (31,649)—J. France.
Brakes for motor vehicles (32,088)—C. E. Idoine.
Apparatus for transmission of power in motor vehicles (31,569)—G. S. Mepstead.
Life guards for tramway vehicles (32,092)—P. C. Philipson.
Combined folding platform step and barrier for tramway cars (32,112)—H. A. Stevens.
Rail joints (31,564)—H. E. Swanson.

BOILER WORK

CONTRACTS UNDERTAKEN

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Tram control systems (32,537)—A. F. Bound.
Direction indicator for motor vehicles (32,571)—R. H. Brade, J. A. Catford and E. R. Graham.
Steering mechanism for road vehicles (32,367)—G. Carwardine.
Brake blocks (32,636)—A. Chaumont.
Automatic direction and stopping indicators for vehicles (32,423)—B. W. Coopey and T. Rideout.
Safety device for tramcars (32,675)—W. F. Craig.
Direction indicators for vehicles (32,219)—G. C. Gnapp.
Route indicators for vehicles (32,447)—A. Johnston and S. G. Martin.
Brakes for tramcars (32,749)—O. M. Lindas.
Rail joints (32,212)—E. C. R. Marks (*G. J. Murphy*).
Tram tickets (32,565)—J. Maxwell.
Brakes for motor vehicles (32,194)—D. Napier and Son and A. J. Rowledge.
Lifting jacks (32,803)—T. B. O'Brien and H. F. Pearse.
Brakes for electric tramcars (32,747)—C. J. Spencer.
Direction indicators for road vehicles (32,826)—J. A. White.
Liquid fuel supply for motor vehicles (33,486)—E. J. D. Buckney and Guy Motors, Limited.
Emergency brake and switch for motor vehicles (33,566)—T. A. Carter.
Lifting jacks (33,069)—A. W. Chapman.
Motor vehicles (32,849)—H. Clayton and B. B. Whitaker.
Operating mechanism for vehicle route indicators (32,942)—E. E. Daglish, W. L. Lorkin and H. B. Swift.
Motor vehicles (33,487)—S. S. Guy.
Tramway rails and tracks (32,909)—R. Haddan (*Atlantis Akt. Ges.*).
Electric overhead lines (32,992)—R. C. Horn and H. F. Tessmann.
Radiators for motor vehicles (33,524)—F. H. Jackson and E. J. Symcox.
Steering device for vehicles (33,425)—W. Kuczmierczyk and F. Niclas.
Motor vehicles (32,847)—J. A. McKee and O. D. Cars, Limited.
Axles of motor vehicles (33,243)—F. J. Mitchell.
Route indicator for tramcars (33,218)—A. M. Pritchard.
Motor vehicles (33,071)—A. H. Treloggan.
Joint for tram rails (33,418)—G. Wardle.
Device for use with gear cases of electric tramcars (33,002)—J. Wilson.
Lifting jacks (32,860, 33,219, and 33,220)—J. H. Windsor.

SPECIFICATIONS PUBLISHED

1919.

Apparatus for burning liquid fuel in steam generators for motor wagons and other steam-propelled vehicles (12,978—*151,671*)—J. J. Kermode.
Motor propelled vehicles (15,800—*151,699*)—M. F. Huxley.
Lubrication of motor vehicles (16,061—*151,708* and 16,866—*152,111*)—S. S. Guy.
Motor vehicle radiators (24,873—*151,825*)—W. Beardmore and Company and T. Broadbent.
Controlling means for motor vehicles (27,736—*151,849*)—W. Pickard and D. R. Dobson.
Radiators for motor vehicles (29,372—*151,858*)—T. W. Fairlie.
Air brake equipments (11,297—*152,057*)—British Thomson-Houston Company (*General Electric Company*).
Automobile radiators (17,713—*152,135*)—P. Gregoire.
Hand-operated brakes for tramcars (21,344—*152,177*)—W. Bardsley.
Wheels for tramcars (25,257—*152,202*)—T. Abbott.
Conductor rails for electric railways, etc. (29,280—*152,230*)—Merz and McLellan and S. G. Redman.
Bogie trucks (30,842—*152,236*)—Gloucester Railway Carriage and Waggon Company and F. Gibbens.
Means for lubricating springs for motor vehicles (32,878—*152,243*)—G. H. C. Lumsden.
Vacuum brake systems for vehicles (16,569—*152,391*)—E. S. Luard.
Indicating device for use on motor road vehicles (17,609—*152,735*)—S. C. Caddy.
Lifting jacks (19,399—*152,810*)—S. Percival (*Duff Manufacturing Company*).
Current collecting shoes (27,566—*152,875*)—H. Haddan (*J. B. Regan*).
Protection guards for vehicles propelled by mechanical power (15,079—*153,036*)—W. Meiklejohn.
Motor road vehicles (18,196—*153,060*)—T. B. Lewis and R. E. Parry.
Radiators for engines of motor vehicles (20,205—*143,179*)—J. B. D. L. Chardard.
Trolley head for electrically-propelled vehicles (24,864—*153,158*)—J. N. Lewis.
Machines for dressing rails (32,297—*153,197*)—J. W. Eunson and Woods-Gilbert Rail Remodelling Company.

1920.

Lifting jacks and haulers (173—*151,875*)—C. E. Clews.
Driving wheel for motor vehicles (4,075—*138,902*)—H. Lanz.
Ratchet lifting jack (13,233—*144,265*)—A. Ottolenghi.
Spring suspension of motor road vehicles (4,974—*141,329*)—R. L. Le Grain and P. H. R. Savary.
Wheels for tramways (545—*153,200*)—J. W. Jennings.

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TRAFFIC RETURNS.

Tramway and Omnibus Undertakings in the United Kingdom.

NAME OF COMPANY OR CORPORATION.	1919. WEEKS ENDED					1920. WEEKS ENDED.					AGGREGATE.		
	Nov. 8	Nov. 15	Nov. 22	Nov. 29		Nov. 6	Nov. 13	Nov. 20	Nov. 27		Wks.	1920.	Increase or Decrease.
	£	£	£	£	£	£	£	£	£	£		£	£
Aberdare Corporation	534	...	571	...	...	546	...	516	...	...	—	—	—
Aberdeen Corporation	3,081	2.914	2.811	3.034	...	3.505	3,637	3,569	3,629	...	25⅝	102,388	+ 16.712
Ayr Corporation	448	413	449	432	...	521	536	545	538	...	28	24,506	+ 2.159
Barrow Corporation	636	602	618	634	...	876	894	927	861	...	34	31,116	+ 4,371
Belfast City Tramways	10.110	9.678	9.775	10,126	...	11,040	11,272	11,125	11,358	...	35	401.124	+ 40.696
Birkenhead Corporation	2.876	2.629	2.838	2.826	...	3,103	3,054	3,088	3,036	...	34½	116,699	+ 14,989
Birmingham Corporation	25.515	25.582	25,938	25.951	...	32.970	33.680	33.206	32,638	...	35	1,074.113	+ 172.670
Birmingham Motor 'Buses	1.543	1.537	1.582	1.595	...	1.843	1.942	1,877	1.767	...	35	70.319	+ 9.701
Blackburn Corporation	2.000	1.853	1.830	1.913	...	*1.803	2.293	2.274	2.424	...	34⅝	91.985	- 10.598
Bradford Corporation	10.673	10.239	10.596	10.785	...	15.114	14.057	14,104	13.520	...	35	451.511	+ 51,383
Burnley Corporation	2,978	2.700	2,829	2,817	...	*2,574	2,993	3.226	3.275	...	—	—	—
Burton-on-Trent Corporation	478	471	507	472	...	560	605	589	580	...	35	20.809	+ 3,218
Bury Corporation	2,210	1,918	2,074	2.104	...	1,746	2,038	2.297	2,200	...	32½	89.461	+ 5,719
Chatham and District	1,300	1,287	1,301	1,349	...	1,624	1,725	1,647	1,589	...	47	81.855	+ 10.508
Cork Electric	710	647	685	707	...	532	716	657	686	...	47	37.611	+ 4,396
Derby Corporation	1.883	1.901	1.874	1.855	...	2,205	2.250	2.327	2.136	...	35	78.778	+ 10.811
Dundee City	2.471	2.395	2.306	2.439	...	3.130	3.159	3.223	3.080	...	27½	83.349	- 12.513
East Ham Corporation	1.883	1.813	1.828	1.843	...	2,073	2.087	2,212	2.015	...	34½	69.739	+ 2.878
Edinburgh Corporation (Cable)	...	8.721	9,105	9,507	...	...	11.665	8.838	11,133	...	28	334,365	+ 26.828
Edinburgh Motor 'Buses	...	...	...	...	...	...	1.313	1,024	1.250	...	—	—	—
Glasgow Corporation	31.972	28.289	30.058	31,910	...	46.256	46,598	47,106	45.841	...	25	1,148,914	+ 320.542
Glossop (Urban Elec. Supply Co.)	215	201	217	220	...	260	261	243	237	...	48	11.367	+ 645
Halifax Corporation	...	...	2.793	3,091	...	...	...	4,292	4.300	...	33½	144.596	+ 20,860
Halifax Motor 'Buses	...	...	66	81	...	...	...	111	106	...	33½	3,765	+ 879
Huddersfield Corporation	4.600	4.343	4.468	4,549	...	5.048	5.132	5.076	4.870	...	35	177.582	+ 6.188
Ilford U.D. Council	1.067	1.044	1.060	1.074	...	1.247	1.277	1.344	1.292	...	34⅜	45.130	+ 3.660
Ipswich Corporation	808	766	788	796	...	816	837	849	804	...	34	34.866	- 2,097
Isle of Thanet	490	444	435	484	...	457	483	491	475	...	7⅜	4.996	+ 337
Kilmarnock Corporation	262	246	280	268	...	342	343	363	345	...	28	10.267	+ 2,160
Lanarkshire	3,831	3.676	3,145	3,753	...	3,909	3.984	3,987	4,044	...	47	199.669	- 24.728
Leicester Corporation	5,828	5,958	5,911	5,814	...	6,349	6,431	6,831	6,414	...	—	—	—
Leyton U.D. Council	...	...	...	...	...	...	...	...	...	...	—	—	—
Liverpool Corporation	23.750	22.749	23.108	24,075	...	25.218	26.612	25.963	25.671	...	47⅜	1.294.026	+ 230.650
London County Council	75,039	74.650	74.813	76.543	...	97.637	95.056	101,575	96.052	...	34	3,014.205	+ 271.870
Maidstone Corporation	331	325	326	346	...	429	424	412	397	...	34½	17.171	+ 3.526
Manchester Corporation	29.432	28.447	28.749	29.819	...	35.743	37.174	37,209	36.096	...	35	1,156.956	+ 101.989
Newcastle-on-Tyne Corporation	9.027	8.439	8.686	9,012	...	11.002	10.946	11,058	10.792	...	33	377.774	+ 49.904
Nottingham Corporation	7,029	6.881	6.730	6.989	...	7.234	7.374	7.399	7.122	...	34	266.654	+ 16.916
Oldham Corporation	4,211	3,944	4.205	4.220	...	4,521	4.557	4,651	4,537	...	36	168.548	+ 8.884
Reading Corporation	1,435	1.457	1,454	1,438	...	1.478	1.543	1.571	1.522	...	34	57.670	+ 2.801
Reading Motor 'Buses	...	...	...	...	...	222	224	241	224	...	34	9.085	—
Rotherham Corporation	2.138	2.029	1.925	2.086	...	2,373	2.470	2.493	2.594	...	34	90.796	+ 18.733
St. Helens Corporation	1.536	1.487	1.394	1.519	...	1,769	1.782	1.849	1.874	...	34	71.639	—
Sheffield Corporation	15.924	15.365	16.313	16.496	...	19.873	20.372	20.356	19.939	...	35⅜	741.876	+ 162.195
Southampton Corporation	2,304	2.294	2.191	2.880	...	3.049	3.088	3.140	2.915	...	34	108.240	+ 15.012
Southampton Motor 'Buses	153	149	137	165	...	212	241	339	313	...	34	7.975	+ 5.771
Southend Corporation	1.299	1.326	1.307	1.338	...	1.634	1.615	1.630	1.546	...	34	87.735	+ 9.521
South Shields Corporation	1,403	1.421	1.384	...	...	1.796	1.866	1.866	...	...	34	65.711	- 17.471
Sunderland Corporation	2,665	2,506	2.648	2.615	...	2,787	2.893	2.810	2,788	...	35	107.208	+ 6.298
Swindon Corporation	339	318	309	323	...	357	361	365	339	...	34	13.358	+ 687
Tyneside Tramways and Tramroads	967	948	903	997	...	1.185	1.219	1.206	1.139	...	21	27.604	+ 860
Wallasey Corporation	2.151	2.022	2.050	1.855	...	2.242	2.234	2.233	1.995	...	34⅜	90.266	- 767
Walsall Corporation	1.478	1.502	1.556	1.533	...	1.592	1.660	1.658	1.589	...	35	60.527	- 8.953
Walsall Motor 'Buses	628	688	724	719	...	975	1.059	1.126	1.059	...	35	38.252	+ 18.680
Walthamstow U.D. Council	1,494	1.429	1.510	1.517	...	1.821	1.797	1.868	1.789	...	34⅜	71.997	- 11.906
Warrington Corporation	885	886	897	926	...	1.012	973	970	949	...	34	33.990	+ 3.666
West Ham Corporation	5.046	4.823	4.927	5,053	...	6.026	5.823	6.298	5.957	...	34½	192.771	+ 6.161
Wolverhampton Corporation	1.883	2.033	2,088	2.207	...	2.247	2.330	2,313	2.217	...	34	83.330	+ 14.258
Wolverhampton Motor 'Buses	...	...	...	335	...	...	...	...	439	...	34	14.557	+ 5.410

* Results affected by Miners' Strike.

Colonial and Foreign Tramway Traffic Returns.

NAME OF COMPANY.		1919. WEEKS ENDED.					1920. WEEKS ENDED					AGGREGATE.		
		Nov. 8	Nov. 15	Nov. 22	Nov. 29		Nov. 6	Nov. 13	Nov. 20	Nov. 27		Wks.	1920.	Increase or Decrease.
		£	£	£	£	£	£	£	£	£	£		£	£
Anglo-Argentine		69,091	69.656	66.298	69.385	...	80,478	77.319	77.952	82.262	...	47	3.587.861	+ 819.170
Calcutta	Rs.	91,613	93.917	88.807	90.968	...	87,097	84,942	94.022	97.524	...	47⅜	4,261.215	+ 271.385
Madras	Rs.	(2 weeks)	43.830	(2 weeks)	44.258	...	(2 weeks)	48.704	(2 weeks)	42,446	...	45	1,088.286	+ 161.744
Pernambuco		6,763	6.800	7,225	7,800	...	5,855	5.685	5,556	5,189	...	47½	313.947	+ 55.650

Companies issuing Monthly Statements only.

	1919.						1920.						Wks.	AGGREGATE.	
	June	July	Aug.	Sept.	Oct.	Nov.	June	July	Aug.	Sept.	Oct.	Nov.		1919-20.	+ or -
	£	£	£	£	£	£	£	£	£	£	£	£		£	£
Ballarat & Bendigo	3,261	2,982	2,192	3.396	4.176	...	3,671	3,689	3,588	4,191	4,441	...	28	28.185	+ 4.619
Brazilian Trac. Mlrs	9369,000	10,070.000	9734.000	9792.000	9980.000	...	10874000	11745000	11837000	12043000	1344200	...	43	110107000	+ 16568000
Brisbane	...	41.610	42.245	41.980	43.530	...	...	53.300	46.650	45,440	46.300	...	43	459,330	+ 69,420
British Columbia	$411,605	542.090	567.170	584.946	710,405	...	710.210	740,200	756 543	756.950	781.706	...	17	3.035.399	+ 330.788
Buenos Ayres L'c'z.	61.356	45.222	46.846	45.310	49.692	...	50.635	51.508	53,952	53.603	57,619	...	17	216,682	+ 29,612
Burma	41.516	44.050	43,683	43,152	51.898	...	50,471	52.289	48,552	50.980	55.763	...	13	155,295	+ 16.562
Cape Town	...	12,792	...	19,759	...	...	...	23.711	...	23,699	...	...	—	—	—
Carthagena & H.	3,373	4.183	2.991	1,539	1,465	2,549	5,562	4,164	3,721	2,273	3,319	2.714	48	44.797	+ 15.279
Cordoba	17,188	18.308	17.627	17.833	17,606	...	20.056	20.197	21.032	19.612	19,636	...	30	140.035	+ 17,366
East India	2,323	2,687	2,761	2.831	2,855	2,709	3,862	4,081	4,109	4,228	4.299	4,234	17	16.870	+ 5.714
Kalgoorlie	2,646	2,815	2.876	3,005	...	...	3,029	3,194	3,111	3,361	...	...	39	27.609	+ 3.071
La Plata	...	5,317	5,729	5,541	6,194	4,905	...	5,353	5,715	5,656	6,310	5.573	48	61.751	- 1.727
Lima	47,855	49.022	49.021	49,144	...	...	55,919	59,685	58,851	56,513	...	...	39	518.414	+ 88.182
Manila	$160.714	189,653	194.019	...	242,441	...	267,169	282.260	292.760	...	327,652	...	43	2.823.018	+ 749.175
Monte Video	34,750	34.039	34,873	...	...	40.308	39,989	39,647	42,771	...	...	43,846	4	43,846	+ 3,538
Para	24,647	24,659	24,890	24,386	27,849	...	25,403	24,254	24,582	23,185	26,784	...	48	272.725	- 1.136
Peruvian	$ ...	...	...	982.850	1179,130	1285.000	...	...	...	1187.300	1187.160	935.050	22	5,633.655	- 38.239
Port Elizabeth	...	3.247	...	4,372	...	...	...	...	6.106	5,303	...	...	—	—	—
Rangoon	6.276	6,562	6,472	6.812	7,678	...	7.849	7.911	7,856	7.657	7.455	...	43	78,350	+ 12.200
Toronto	$842,697	977,262	1083.741	1124,159	1123.801	...	1127,239	1189,315	1225,682	1270,651	1218.290	...	43	11949.686	+ 1,507,427
Winnipeg	$112,615	337,978	353,194	381,248	428,339	...	407,625	391,709	368,616	426,647	444,899	...	43	4,276,548	+ 901,149

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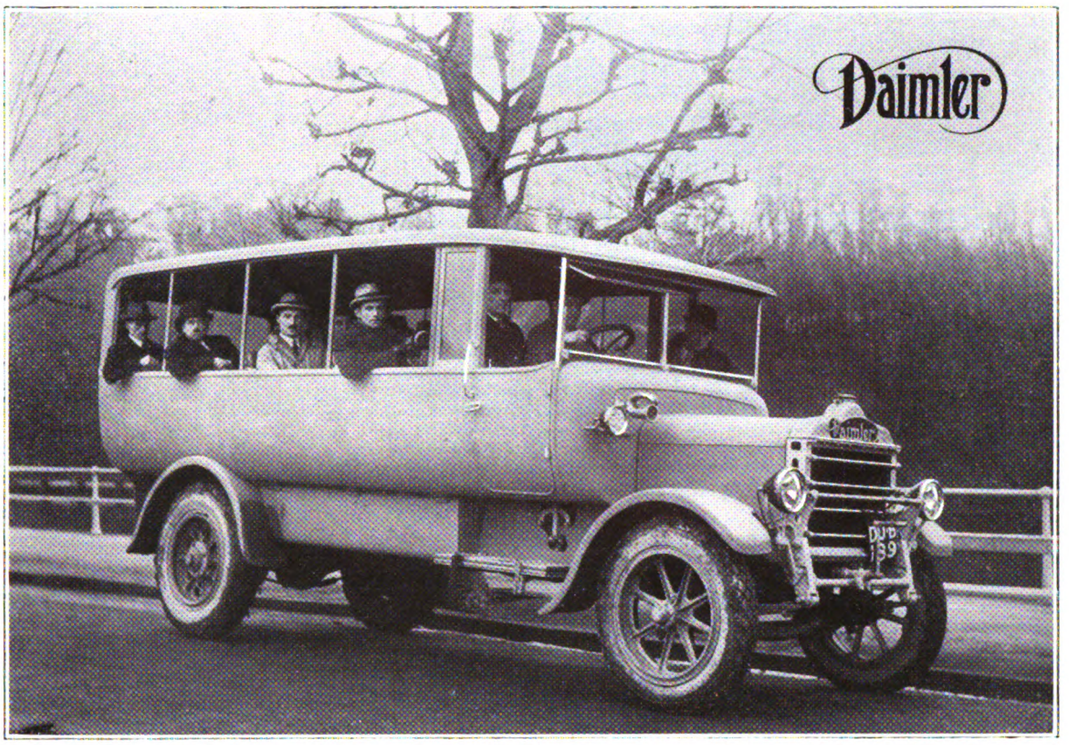

The Daimler Motor Coach on the road at Maidenhead, November 29th, 1920.

Passengers enjoy riding in the Daimler Motor Coach

—because of its comfortable seats and absolute protection against all bad weather.

At any angle of vision the passenger obtains an open view of the country-side and the driver being fully protected can always do full justice to his work. From the driving seat there is no obstacle to the line of sight even when climbing or descending the steepest hill. The lamps and wings are always in full view. Ask your driver what this means to him when he is negotiating traffic and what a bearing it has on safety!

Comfort and safety mean revenue, for the public fully appreciates the qualities of the Daimler Chassis.

The Daimler Company Ltd., Coventry.

II

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AEC

Reg.d.

COMMERCIAL MOTOR VEHICLES

A. E. C. "K" TYPE CHASSIS.

This Chassis is specially designed as an economical and efficient vehicle, particularly suitable for passenger carrying. The arrangement of the driver's position at the side of, instead of behind the engine, increases length of loading platform by 3' 6" without adding to the overall length of the chassis. The design also allows a more even distribution of load on the axles and reduces the body overhang behind the rear axle. This feature, in conjunction with the specially designed springs, provides an exceptionally comfortable riding vehicle.

FURTHER PARTICULARS AND COMPLETE SPECIFICATION ON APPLICATION.

Chassis Price, £1,200.

NOTICE.

Will owners of A.E.C Vehicles not purchased direct from the Company or from its Agents, communicate with us, giving Chassis Nos.

Inspectors will call from time to time to assist and advise them on economical working. Our help and advice is free.

Drivers' Instruction Books for A.E.C. (Y.B. & Y.C.) type Chassis, **free on application.**

Please quote Chassis No.

Write for Catalogues of Passenger & Goods Vehicles :

ASSOCIATED EQUIPMENT CO. LTD.

WALTHAMSTOW, LONDON, E. 17.

Telephone : Walthamstow **780** (9 lines.
Telegrams : "Vangastow, Waltstreet, London."

BUILDERS OF LONDON'S BUSES

Reg. 185

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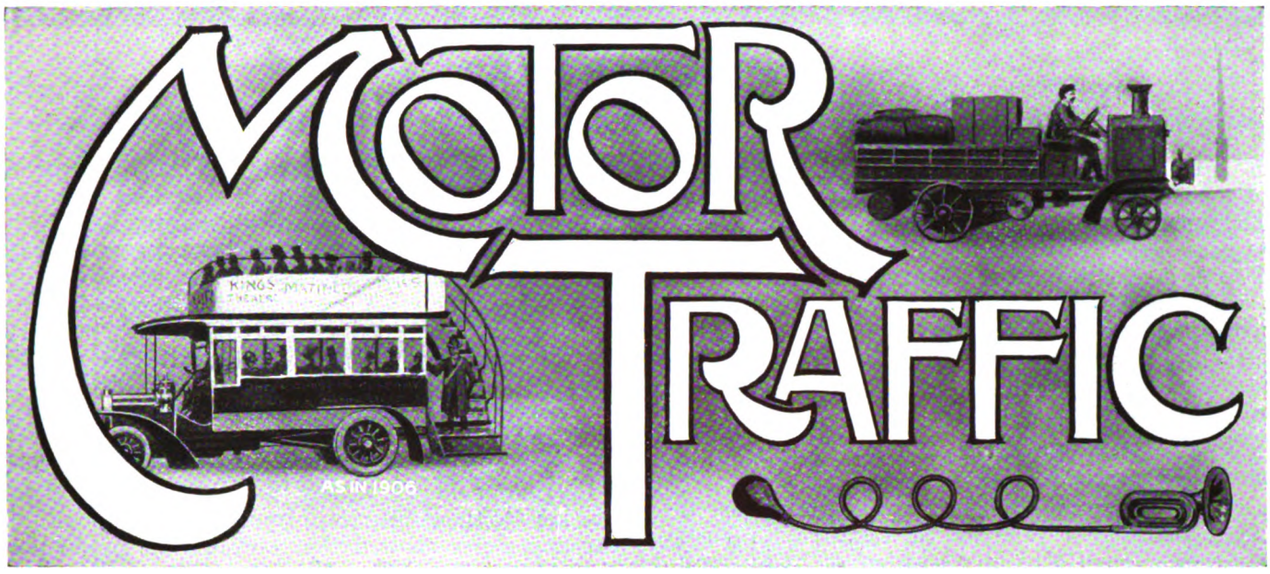

THE MOTOR CAR SHOW.

The car show at Olympia and the White City was undoubtedly, from the business point of view, more successful than had been generally anticipated. It was held under difficult conditions from every standpoint. It took place at a period of considerable uncertainty and trade depression; and the prices of many commodities were beginning to drop, and in some instances reductions of prices of motor cars had already been announced. Thus, on the one hand, there were grounds for fear that the public demand would be curtailed owing to a general lack of money, and on the other that such business as might otherwise eventuate would be postponed because prospective buyers might anticipate that if they held up their orders they would be able to buy at more favourable prices in a few months. Then again, as bearing upon the attendance at the exhibition, we had the unfortunate fact that when it opened the effects of the miners' strike upon railway services had not yet disappeared, and the arrival of visitors was thus rendered more difficult. Finally, the weather conditions were by no means favourable. Despite all these deterrent influences, the attendance, though not quite so large as last year, was very considerable, and business done, particularly by British firms marketing moderate priced cars, was highly satisfactory. As regards the exhibits, the general tendency was in the direction of reaction towards the normal design, after a very natural emanation of original notions last year. In 1919 there were a considerable number of car exhibits in which the exhibit itself represented the whole of the exhibitor's output up to date. Later on many of these newcomers were eliminated as the result of thorough practical tests, and others again by reason of inadequate financial support. In yet other instances firms which had showed a desire to bring out something revolutionary have evidently found reason to change their programme, and to put into production a chassis on more normal lines. In the great majority of cases the tendency of manufacturers to concentrate upon the quantity production of one or two models was very noticeable. Where two models are produced they are often identical in very many particulars, so that for the most part they really represent a single standardised product. There is also noticeable a tendency towards the grouping up of firms and their combination with a view to large scale production.

REGISTERING VEHICLES IN 1921.

At the time of writing the details as to the procedure which motor vehicle owners must follow in order to register their machines in 1921 have not yet been published. It will, however, be found that, so far as concerns the licence card and the document to be known as the registration book, the procedure has been simplified as far as possible, and that when we take into account the objects which it is sought to obtain, there remains very little room for criticism as to the procedure as distinct from certain of the principles involved. In respect of the principles, it seems most unfortunate that the Ministry could not be induced to allow licences to cover a fixed period from any date. As things are, if one were to take out a licence for a new vehicle on March 15, the duty for the whole of the first quarter of the year would be payable, and there would be a liability for a further payment on April 1. Obviously this sort of arrangement must tend to restrict business in vehicles during the last few weeks in each quarter, concentrating it during the first few weeks. This would seem to mean regular alternate periods of pressure and comparative idleness in certain departments instead of a constant equal distribution of pressure, which is the ideal for economical working.

* * * *

It remains to be seen whether, and, if so, how, the Ministry of Transport will get over certain difficulties as regards the classification of vehicles and the consequent basis of the licence payments to be made in respect of them. A commercial goods-carrying vehicle is defined as a vehicle constructed and adapted and used solely for the carriage of goods or merchandise in the course of trade. Supposing it is intended occasionally to use a vehicle of this class for the carriage of passengers, then it would obviously become illegal to pay its licence on the basis of unladen weight. Its use as a passenger carrier automatically converts it from the legal standpoint into a private motor vehicle. Under the old scheme this simply meant the payment of a higher duty. Under the new scheme the reverse will sometimes prove to be the case. It may be actually cheaper to register certain vehicles as private cars than as goods-carrying vehicles. For this reason it is understood that the Ministry will make a regulation prohibiting the registration of a vehicle of the

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van or lorry class as a private car. The difficulty is that such prohibition would leave the owner of the vehicle unable to register it in either class, and therefore possessed of a vehicle having no legal status at all. The position in respect of a lorry occasionally fitted up with temporary seating accommodation, and let out to holiday parties by its owner, who is not a jobmaster by profession, seems to be equally ambiguous, and we cannot help thinking that there will be a good deal of trouble before all these cases are equitably settled.

INDUSTRY AND LEGISLATION.

Despite the success of the recent exhibitions, the general condition of trade and the taxation of industry are together such that the position of many motor manufacturers at the moment is by no means an enviable one. Neither does it seem probable that the Government will take any steps in the near future that are calculated materially to improve that position, unless it be by the removal, or at any rate a reduction, of the Excess Profits Duty. If any guarantee of such a change of policy were obtainable now, the position would be very much eased, but unfortunately there was nothing whatever in the Prime Minister's speech at the dinner of the Federation of British Industries that could be construed into a hopeful augury, much less than into a definite undertaking such as is needed in order to give confidence and the necessary feeling of security. All that can be said is that the Government has at least forecasted its intention of legislating in the interests of key industries and with a view to the prevention of dumping. How far legislation of either kind can affect the position of the motor industry remains to be seen, but a few comments may perhaps usefully be made at the present stage, when the policy to be pursued is still in a somewhat nebulous condition.

KEY INDUSTRIES.

Efforts made in the House of Commons to get from the Government a clear definition of what they consider a key industry have not met with success, but during the summer of last year the Prime Minister made a statement which seemed to sum the matter up substantially as follows. A key industry is one which at the outbreak of war had not been developed up to a point enabling Great Britain to be independent of imports. It is an industry the products of which are essential to the continued conduct of some greater industry that is itself essential, at least in time of war and probably in time of peace also. It will be noted that a key industry must be a young or undeveloped industry. Its youth, and the necessity for increasing its development, are the excuses for sheltering it until its growth becomes robust, and it is able to bear the full force of competition. Now, so far as the motor industry is concerned, it is generally recognised that the production of ignition apparatus represents a key industry. This was brought home to us in 1914 owing to the fact that it was then discovered that we were almost wholly dependent upon Germany for magnetos. The British magneto industry was then brought into existence, having previously been negligible in extent, because it was vital to our success in war, unless we were to continue to take the risk of being dependent on the import of magnetos from the United States. Now our magneto industry is in great difficulties. German magnetos are being offered, chiefly through Holland, in large numbers and at prices only rendered possible by the immensely decreased value of the mark. The existence of the British industry is threatened, and if the Government can get its proposals through it seems practically certain that something will be done to safeguard this particular development.

So far as any definition is concerned, various branches of the motor industry may themselves fairly claim to be keys to the industries of transport and agriculture. War experience showed that our pre-war production of commercial motor vehicles was not sufficient to fill our needs in the event of war; that the large scale use of these vehicles was essential; and that the output of the industry must be—as it was—vastly increased. Now this industry is subjected to the full force of competition, assisted in many cases by the rates of exchange and aggravated by the marketing of huge numbers of second-hand Government machines. The Government has not, however, indicated the slightest intention of classifying it as a key industry, though it would seem very necessary that something should be done to assist industries such as those which may be described as lying upon the border line, because, though essentially key industries in character, they were already fairly well developed before the war.

THE QUESTION OF DUMPING.

As regards legislation against dumping, there are indications that the Government itself is half-hearted, and that the House of Commons may be antagonistic. In any case it is difficult to see how such legislation could appreciably assist our motor industry unless it were devised so as to take account of current rates of exchange. These are such as to render competition in overseas markets extremely difficult, which makes it all the more imperative that the home markets should be temporarily reserved for the British manufacturer as a solid nucleus on the strength of which he can lay plans for substantial output. Failing such a nucleus, he cannot develop the principles of quantity production, and therefore cannot manufacture on the most economical lines, a fact which, of course, reacts to the detriment of the motor user. It is well known that many of the principal items of expenditure, as, for example, the wages bill, do not correctly reflect the rates of exchange. The French or Italian workman and still more the German are paid at rates which, if converted into British currency, under the present exchange, would be ridiculously low as compared with those in force in this country. Thus the British manufacturer is heavily penalised in competition; but if anti-dumping legislation can be so framed as to equalise this handicap due to the decreased value of our neighbour's coinage, the benefit to the motor industry would be very great. The practical difficulty of devising such legislation is, however, so great that it is to be feared the motor industry must face the future without expectation of material aid from any other source than its own enterprise.

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LONDON'S NEW OMNIBUS.

57-SEAT VEHICLES PLACED IN SERVICE TO TEST ECONOMY OF OPERATION AND FARE COLLECTION.

The new S model of the London General Omnibus Company bids fair to prove the efficacy of private enterprise to solve problems that are agitating passenger transport circles. The high cost of labour combined with the extra expense of fuel have served to render the London omnibus service unprofitable. Though the increased fares which recently came into operation may make good the deficiency, the company's officials are not content to rely upon passing the burden on to the passengers, of whom many are unable to bear further imposts. The mechanical and operating heads have not only set themselves to provide a vehicle that shall give more economical running, but are also tackling the question of traffic congestion in Central London. While proof has yet to be given of reduced working costs, no one can deny that from the outset the S machine will do much towards reducing congestion, for its increased seating capacity enables two of the new vehicles to carry as many passengers as three of the B class. The latter was introduced a dozen years ago, and still constitutes the great majority of the fleet. This enlarged capacity should alone have an effect upon working costs. Contrasted with the K type, the new vehicle has eleven extra seats. Taken in conjunction with the fact that passenger traffic in inner London is mainly for short distances, besides being heavy in volume, the increased seating renders the vehicle a test of the system of fare collection.

Externally, the S omnibus resembles in length of body and general appearance, the omnibuses to be seen in Fifth Avenue, New York. While it retains the merit of a lower loading height of the K type introduced about a year ago, the body of the S omnibus is more pleasing in appearance. Its increased seating accommodation has involved an addition to its weight, but not to an excessive extent Moreover, it provides more comfortable riding, attained by improved springing. Enlightened administration of the Ministry of Transport and of the public carriage department of the police authority has approved of the added weight, the extent of which will be best grasped from the subjoined figures embracing the three classes of vehicle now being run by the London General Omnibus Company—

Type.	B.		K.		S.		
	Tons.	Cwts.	Tons	Cwts.	Tons	Cwts.	Qrs.
Weight, unladen ...	3	10	3	9	4	3	3
Weight, laden ...	6	0	6	13	8	0	0

A suggestion emanating from the Ministry of Transport led to an addition of one seat to the original total of 56. This is gained by removing the schedule of fares from its old position in the centre of the space at the rear of the driver to the ventilators just below the roof. Thus five persons in place of four can sit on the new transverse seat which has been placed here, the passengers facing those in the main part of the saloon. Like all the other inside seats this is comfortably upholstered, a circumstance which, added to speed, accounts for the popularity of the London omnibus.

The building of the S type is proceeding concurrently with the output of the K vehicles, nearly 500 of which are now in service, while as many more are on order, and will be completed early in 1921; the output amounts to about 30 per week. Fifteen of the new pattern are being constructed for trial purposes, mainly on the long central route from Hammersmith to the City, upon which congestion is most in evidence. The first S omnibus made its trial trip on November 16, when the party on board were much impressed with the fact that it represents a gain of 23 seats over the familiar B type, and of 11 seats over the more recent K type.

London General Omnibus Company's S Type. It Seats 57, and has a 34-h.p. Engine.

Features of the New Vehicle.

The S is an ingenious development of the K vehicle. The great gain in seating is achieved with a comparatively small increase of unloaded weight and with a notably slight increase of road occupation. The overall length is 24 ft. 7 ins., the body being only 2 ft. 2¼ ins. longer than that of the K type. The extra length of the body allows for a narrow additional side-window, between two centre pillars which give added strength to the body where it is required. The space between these pillars provides a convenient position over the side-glass for another new feature—an illuminated service number. The front framing of the body has also an extra pillar which gives extra strength for the additional load carried on the top deck. The top deck seats are carried back as far as possible to lighten the roof load on the front axle.

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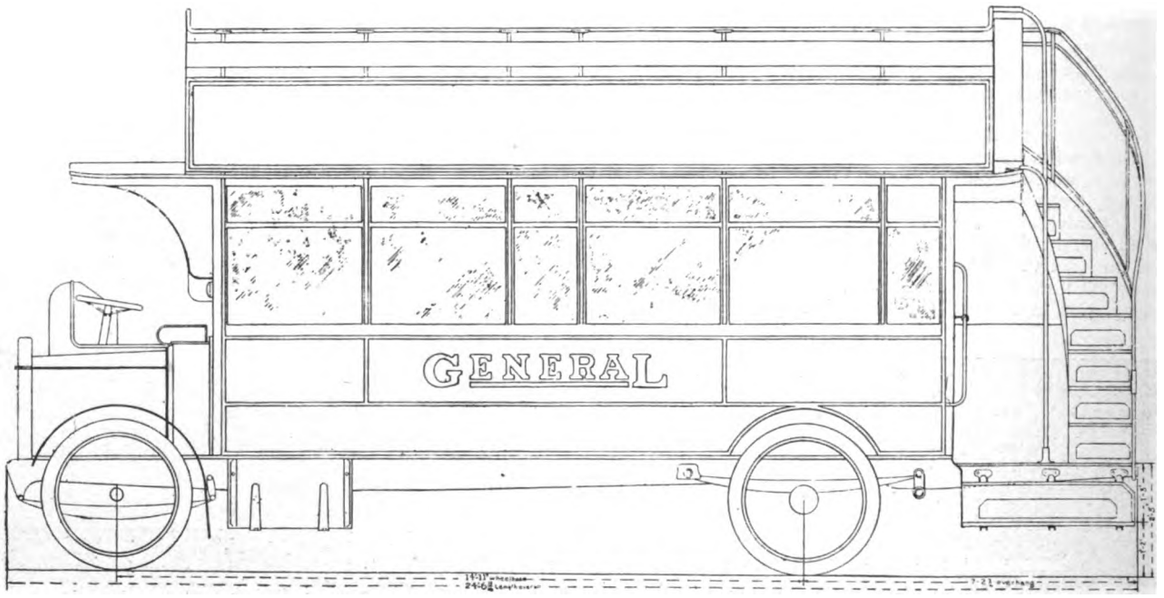
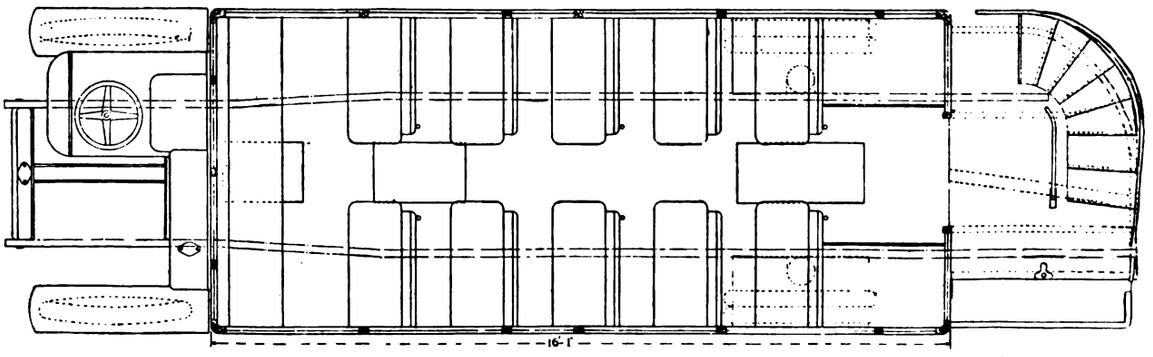
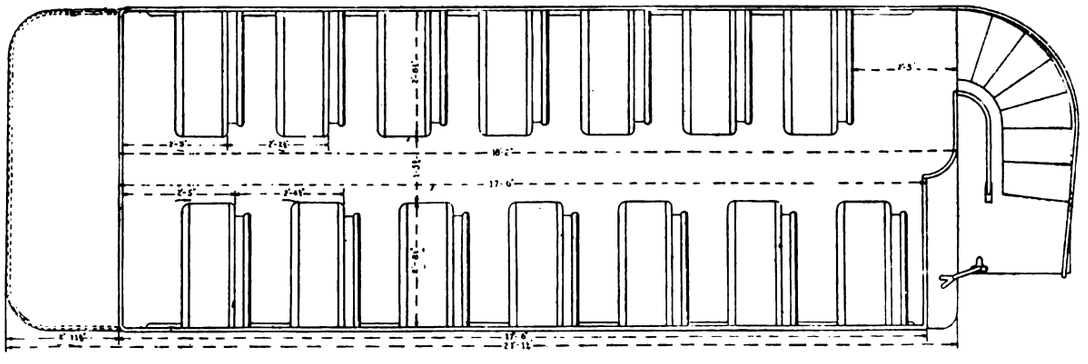
ELEVATION AND PLANS OF LONDON'S NEW (S TYPE) OMNIBUS.



Side Elevation of the S Type Omnibus.



Plan of Inside Seating giving accommodation for 29 Passengers.



The Top Deck with Seats for 28 Passengers.

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The inside seating, although providing for 29 seated passengers, leaves a wide aisle down the centre and a good space for the conductor on the rear platform. A new feature is that 5 passengers sit side by side at the front end with their backs to the driver, while

Oblique View Showing the Driver's Elevated Seat.

the rear longitudinal benches seat two passengers, instead of three as in the K type. The remaining twenty inside passengers face forward, in five rows of two double seats on either side of the aisle. Inside, there are six brass stanchions, as against 4 in the K type.

Top-Deck Seats for 28 Passengers.

These are necessary, owing to the extra length of the body, to form "grab-handles" for the assistance of passengers taking or leaving their seats. As in the K type there will be no strap-hanging in the new S model.

The S chassis is provided with special springing arrangements. The variation of passenger weight between empty and full load is naturally considerable, but by the fitting of compound volute springs, front and rear, comfort is assured under all loading conditions. This improved springing, combined with the very large wheels and special resilient tires, reduces road shock and road damage to a minimum. The driver's seat, as in the K type, is arranged on the offside of the engine. The new 57-seat S type has now to be put to the test of full operation, and the highest expectations are entertained of its success and popularity. Over 200 have at present been ordered, and 15 of these were to be seen at work at the middle of December. The chassis of the S type is built by the Associated Equipment Company at Walthamstow, the manufacturers of the "A.E.C." 3-ton lorry.

The principal points of difference in S and K* types are shown below—

SEATING CAPACITY.

S Type. 57 passengers (29 inside and 28 outside).
K ,, 46 ,, (22 ,, ,, 24 ,,).

DIMENSIONS.	K TYPE.	S TYPE.
	ft. ins.	ft. ins.
Overall length from front of Dumb Irons to rear of platform	22 6	24 7
Overall height (loaded)	12 3	12 $3\frac{1}{4}$
Overall width (over mouldings)	6 10	7 1
Wheel base	12 $10\frac{5}{8}$	14 11
Wheel track	5 10	5 10
Rear overhang from centre of hind wheel...	7 $7\frac{1}{8}$	7 $2\frac{3}{4}$

* Description, photographs and drawings of the K type omnibus were given in THE TRAMWAY AND RAILWAY WORLD of July 17, August 14, and October 16, 1919.

View of Part of Saloon with Seats for Five at Front.

The extra length in the body is taken up with a narrow window 1 ft. $4\frac{3}{4}$ in. wide. The two centre pillars strengthen the body considerably at a point where it is required, at the same time making a convenient space over the side-glass for an illuminated service number The front framing is different to the K type in that there is an extra pillar, which strengthens up for the additional passengers carried on the top deck.

The roof seats are carried back 10 in. over the rear canopy so as to take as much weight as possible of the roof load off the front axle. This has necessitated making an alteration in the design of the rear canopy and staircase, although the distance from the rear of the body to the rear of the platform is exactly the same as the K type. The outside stringer of the staircase has also been so arranged as to take the same advertisements as the K type.

The inside seating has been arranged so as to give the greatest seating capacity, at the same time leaving a wide aisle down the centre and a good space for the conductor at the rear end of the body. One feature is that five passengers sit at the front end with their backs to the driver, and the rear longitudinal seats carry two passengers instead of three, as in the K type.

The S body has six brass stanchions, as against four in the K type, which are necessary owing to the extra length of the body. These also form grab handles for passengers in taking their seats.

The engine, 108 bore by 140 stroke, develops 34 H.P. at 1,000 r.p.m. The valves are on one side. The camshaft and magneto are driven

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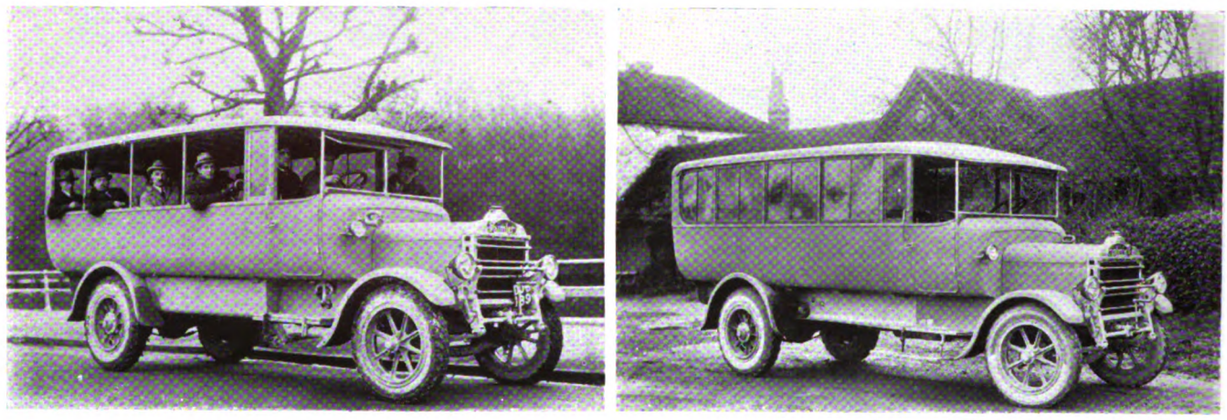
by three-point silent chain with magneto drive arranged to slide for adjustment. Water circulation is by pump incorporated in the fan bracket, the drive being by belt from the magneto shaft. Lubrication is by trough and pump with adjustable troughs. The K type three-speed chain-driven gear box is retained, and the rear axle is also similar in design, but with 9¼ to 1 worm reduction and stronger casing and tubes. The rear wheels run on parallel roller bearings, and carry 1050 by 120 mm. twin tires. The front wheels have Timken roller bearings, and carry tires of similar size to the rear. The front axle is of I section stamping in medium carbon steel, suitably heat treated. The gilled tube radiator is interchangeable with the K type.

The springing comprises compound springs both front and rear, also semi-elliptic main springs both front and rear, in each case assisted by compound volute springs. In this chassis the variation of passenger weight on the front axle between empty and full load is sufficiently great to warrant the fitting of compound volute springs on the front axle in order to obtain reasonable comfort under all loading conditions.

NEW DAIMLER COACH.

Great interest was displayed, at the Commercial Motor Exhibition in October, in the first attempt to provide an all-weather coach. The makers were the Daimler Company, Limited, and the opinion was generally expressed that the company's design department had produced a satisfactory solution of the problem. That a similar result is experienced with the vehicle in service was proved to a party of 24 passengers who took a ride in the coach on the Maidenhead road on November 29. The vehicle has a permanent roof and celluloid windows, which slide into recesses in the roof when not required for shelter from rain or wind. Most efficiently upholstered, and fitted with giant pneumatic tires, the new Daimler model was a revelation in comfortable riding, and it should be the means of revolutionising touring by coach, a traffic which has brought great prosperity to hotel proprietors in this country after the lean years of the war.



New Daimler All-Weather Motor Coach.

OMNIBUSES FOR ABERDEEN TRAMWAYS.

On the recommendation of Mr. W. Forbes, general manager of the tramways, the Aberdeen Tramways Committee have decided to purchase four omnibuses in order to provide traction facilities on the Menzies Road. In the appended report Mr. Forbes gives the comparative cost for tramways and omnibuses—

TRAMWAYS.	
Capital expenditure (including permanent way, double track, bonding cables, section boxes and switch gear, and overhead equipment and poles)	£32,014 15 2
Annual charges (including interest and sinking fund and depreciation and renewal)...	3,942 9 0
Working expenses (including traffic and general charges, electric current, maintenance, and repairs)	6,410 14 4
MOTOR OMNIBUSES.	
Capital expenditure (four omnibuses) ...	£8,000 0 0
Annual charges (including interest and depreciation)	1,615 0 0
Working expenses (including traffic expenses and general charges, petrol, maintenance and repairs)	7,895 14 5

Taking the revenue at 106,579 car-miles at 19s. per car-mile, a total of £8,437 10s. 1d., this would leave a deficiency on the year's working of £1,915 13s. 3d. on tramways, and £1,073 4s. 4d. on omnibuses, as follows—

	Tramways.	Omnibuses.
Gross total expenses ...	£10,353 3 4	£9,510 14 5
Estimated revenue ...	8,437 10 1	8,437 10 1
Loss	£1,915 13 3	£1,073 4 4

NATALITE MOTOR SPIRIT.

THE REASON OF THE HIGH DUTY.

In the House of Commons Mr. Jesson asked the Chancellor of the Exchequer the reasons for excluding Natalite motor spirit from importation into the United Kingdom by making it subject to a high duty when this fuel is being so successfully used in South Africa, and its manufacture and use approved in Kenya Colony, India, and Australia; and if he is aware that if this duty is not removed large quantities of this spirit will be diverted to foreign markets?

Mr. Chamberlain.—I may say shortly that it is necessary both for the protection of the revenue, having regard to the high rates of duty on spirits at present in force in this country and in fairness to home manufacturers, that all spirits intended to be used as motor fuel should be denatured here under the supervision of the revenue officers in a manner approved by the Commissioners of Customs and Excise. The importation duty free of Natalite, or any other spirit denatured abroad, would involve risks to the revenue which, as at present advised, I am not prepared to take.

Mr. Jesson.—Is the right hon. gentleman aware that Natalite is satisfactory in South Africa, and that there is no abuse of the excise?

Mr. Chamberlain.—I think it necessary for the reasons I have stated that the denaturing should take place in this country under supervision and in accordance to the formula approved by the revenue authorities.

THE RIGHT TO RUN OMNIBUSES.—Despite the opposition of the East Grinstead Rural District Council, the Ministry of Transport, on the appeal of the East Sussex Traction Company, have given power for the running of motor omnibuses over certain routes, though the Ministry have scheduled some roads as unsuitable for omnibus traffic. As, however, the Ministry of Transport have made no mention of contributions by the company, the District Council have decided that no special expense can be entertained in improving the roads.

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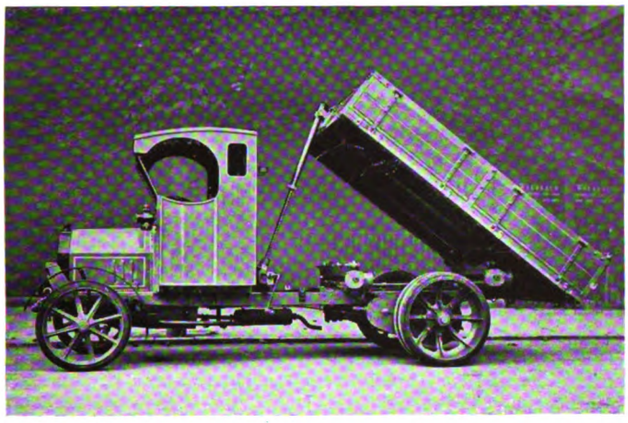
EAGLE PATENT TIPPING WAGONS.

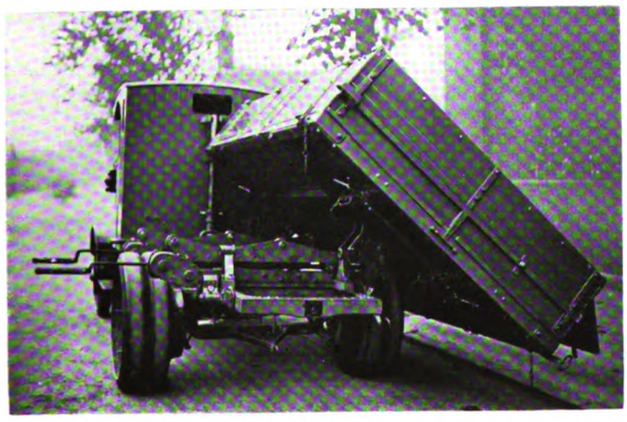
The accompanying illustrations show views of the combined end and side tipping body made by the Eagle Engineering Company, Limited, of Warwick. They are mounted on 5 ton "Fiat" chassis, and for ease of manipulation leave little to be desired. This type of wagon has been specially designed to meet the requirements of county and borough surveyors, contractors, and others engaged upon the work of road making and road repair, and in view of the enormous amount of work of this description which will have to



Rear Action of the Eagle Tipping Wagon.

be faced during the next few years will be of considerable interest to our readers. It has the advantage of tipping either side or at the end without any jar or undue strain falling upon any part of the vehicle; moreover, stones or other material can be deposited on either side of the road without the necessity of drawing the wagon across the road, as the tipping mechanism carries the body well clear of the chassis before depositing the load.

For side tipping the body is operated by means of two right-hand screws, by which means the body is moved sideways upon rollers



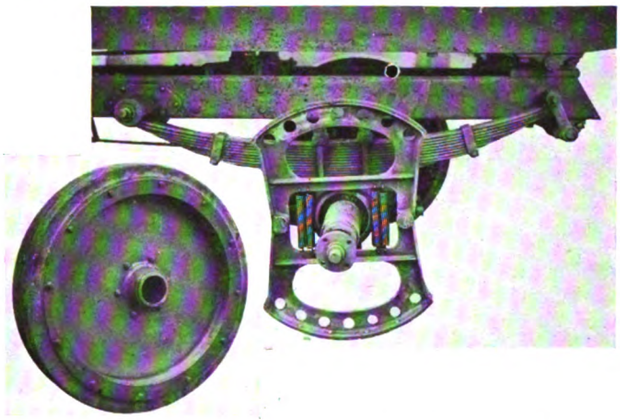
Eagle Tipping Wagon—Side Action.

in a horizontal direction until it is practically balanced upon the outside rollers. At this point two steel locating stops, curved to suit the diameter of the roller, engage with the outside rollers on the side to which the load is to be deposited, after which gravity completes the operation. By reversing the direction of the handle the body is quickly brought back to its original position in the centre of the wagon. To tip the body in the reverse direction all that is necessary is to withdraw the two toggle pins which connect the links from the screw to the body, and insert same in the holes provided at the other side of the centre of the body. The conversion from side tipping to end tipping and *vice versa* is an equally simple matter, and can be effected in a few seconds.

In addition to the tipping body illustrated, the Eagle Engineering Company specialise in tipping trailers constructed upon similar principles. These wagons are built on standard sizes to carry 3, 4, 5 and 6 tons, and are made of the best selected material to stand hard and continuous work. The four side doors, which are hinged from the top, are lined with sheet steel to prevent any wear taking place, and the whole body can be so lined if required. The trailer wagons are mounted on suitable springs carried on through axles with drabble arms and caps for lubrication. A screw brake, acting on both rear wheels, is provided. Spring draw bars are fitted.

VULCAN HILL-CLIMBING TEST.

A notable effort to meet the strenuous conditions imposed by overseas roads is being made by the Vulcan Motor Company, of Southport. By introducing several new features into the design of their latest 30-40 cwt. lorry they have rendered it a particularly suitable vehicle for Colonial use. Indeed, they claim to have produced a machine that will virtually go anywhere and carry out the essential work of transportation even where roads do not exist. This has been made possible by the new design of the back axle, and by the speed wheel equipment which is supplied for fitting to the rear wheels of vehicles intended for such service. A new brake of exceptionally large surface has also been standardised.



Mechanism of new Vulcan Brake showing extra long shoes.

In order to demonstrate the high reserve of power possessed by the 20 H.P. standard engine fitted to the Vulcan chassis, a remarkable hill-climbing test was recently carried out in the presence of a number of Press representatives. A standard 30-40 cwt. lorry, loaded with 35 cwts., plus three passengers, towed a fully loaded 18-seat Vulcan chars-a-banc up the entire length of Fitzjohn's Avenue, N.W., at an average speed of 8 miles an hour. The average gradient is given as 1 in 15, the steepest part being 1 in 12, and the ascent was made without the slightest suggestion of overheating. Immediately following this climb, a further test, which, although of much shorter duration, was even more remarkable in character, was made. The machines were taken to Netherhall Gardens, a turning off Finchley Road, where the gradient is 1 in 5 at its steepest. After the chars-a-banc had again been roped to the lorry, the same load was successfully towed to the top. The tests, which were carried through without a hitch, clearly indicate that the Vulcan chassis is equipped with a power unit of very high efficiency, having greater potentialities for haulage than its nominal rating of 20 H.P. would suggest.

On the return journey to town the chars-a-banc descended the steep slope in order to demonstrate the power and efficiency of the new brake, and at the request of our representative the vehicle was brought smoothly to a standstill on the steepest portion of the gradient.

As will be seen from our illustration, the new brake is of the internal expanding variety, with extra long shoes operating on the rear wheel drums, which are 26 in. in diameter. The shoes are 2½ in. in width, and in conjunction with the huge drums afford a braking surface of extraordinary power.

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MOTOR TRAFFIC

MOTOR TAXATION AND REGISTRATION.

PROVISIONS COMING INTO OPERATION ON JANUARY 1.

Mr. Neal, Parliamentary Secretary to the Ministry of Transport, on November 26 introduced in the House of Commons the Roads Bill, providing for the new taxation and registration of mechanically-propelled vehicles, and making certain changes in the Motor Car Acts of 1896 and 1903. Under the Bill the proceeds of the taxation are to be paid into the Road Fund to be established, and are to be entirely devoted to the maintenance of the highways.

The Act is to come into operation on January 1, on which date the following increased duties imposed by the Finance Act, 1920, will become payable by the owners of the various classes of vehicles—

Cycles, motor scooters, etc.	from 30s. to £4
Invalid vehicles	5s.
Tramcars	15s.
Other hackney vehicles, according to seating accommodation	£12 to £70
Locomotives, tractors, agricultural tractors, etc., not used for hauling on roads	5s.
Locomotives and agricultural engines used for general haulage, according to weight	£25 to £30
Agricultural tractors and engines used for haulage, solely in connection with agriculture, according to weight ...	£6 to £10
Tractors of any other description ...	£21
Vehicles used solely for the conveyance of goods in the course of trade, according to weight	from £6 to £30
Other mechanically-propelled vehicles, not exceeding 6 H.P. (with an addition of £1 for each unit of horse-power) ...	£6

LICENCES TO BE EXHIBITED ON CARS.

Every licence must be fixed to and exhibited on the vehicle in respect of which it is issued. The mark indicating the registered number and the Council with which the vehicle is registered must be fixed on the vehicle, and if such mark is not so fixed, or if it is in any way obscured or rendered or allowed to become not easily distinguishable, the driver will be liable for each offence to a penalty of £50.

The licence cards will have different colours for different periods. The annual licence for 1921 will be yellow, and the quarterly licence for the quarter ending March 24, 1921, will be yellow. The colours for the remaining quarters of 1921 have not yet been settled.

Quarterly licences will be issued on payment of 30 per cent. of the full duty in respect of vehicles other than motor cycles, tramway cars, and those paying a nominal duty of 5s. Motor drivers' licences will continue to be issued by County and County Borough Councils, but the Councils will no longer retain the fees, which will form part of the Road Fund. It will devolve upon the Councils to satisfy themselves as to the horse-power of private cars, the unladen weight of commerical vehicles, the seating capacity of hackney vehicles, etc., in accordance with the regulations to be issued by the Ministry. The regulations will continue the existing formulæ for the ascertainment of horse-power.

Persons applying for a licence must make such declaration and furnish such particulars as may be prescribed, and the licence holder will not be entitled to use any other vehicle than that in respect of which the licence is issued. Any change in the vehicle will invalidate the licence, but a new one will be issued on payment of the additional amount, if any, applicable to the altered circumstances.

REGULATIONS AND PENALTIES.

Where a licence has been taken out as for a vehicle to be used solely for a certain purpose and the vehicle is at any time used for some other purpose, the person so using the vehicle shall, if the rate of duty chargeable in respect of a licence for a vehicle used for that other purpose is higher than the rate chargeable in respect of the licence held by him, be liable on summary conviction to a penalty of an amount not exceeding three times the difference between the duty actually paid on the licence and the duty payable on a licence appropriate to a vehicle used for that other purpose or £20, whichever amount is the greater. Provision is made for issuing on prescribed conditions, a general licence to dealers and manufacturers.

Hackney carriages will be required to exhibit in conjunction with the mark required to be fixed on the vehicle indicating its registered number, a distinctive sign indicating that the vehicle is a hackney carriage and the number of persons which it seats. The penalties imposed in relation to the identification mark will apply. If on any occasion more persons than the prescribed number are carried, the owner will be liable on summary conviction to a penalty of an amount not exceeding three times the difference between the duty actually paid on the licence and the duty payable on a licence for a vehicle seating the number of persons so carried, or £20, whichever amount is the greater.

Any person who uses any vehicle without having a licence authorising its use, or who, being a holder of a general licence uses on any road at any one time a greater number of vehicles than he is authorised to use, will be liable to an excise penalty of £20, or an excise penalty equal to three times the amount of the duty payable in respect of the vehicle or vehicles, whichever is the greater. Proceedings for a penalty under this sub-section may be brought at any time within a period of three years from the date on which the offence was committed.

For making a declaration or furnishing particulars which are false or misleading in any material respect the penalty will be £100, or six months' hard labour.

The Minister of Transport is empowered to make regulations generally for the purpose, among other things, of—

Prohibiting or restricting, on the application of the County Council concerned, the driving of any vehicle or any class of vehicle on any specified highway or part of a highway; and

Extending any provisions as to registration, and provisions incidental to any such provisions, to any vehicles in respect of which duty under Section 13 of the Finance Act, 1920, is not payable and for providing for the identification of any such vehicles.

SECOND READING OF THE BILL.

In the House of Commons, on December 2, the Bill was read a second time, and referred to a Committee of the whole House. Sir E. Geddes said the new taxation would, in a normal year, allow of £1,250,000 being expended on new roads, and the remainder on the maintenance and improvement of existing roads.

Lord Curzon objected to the heavy penalties imposed under the Bill, and Sir W. Joynson-Hicks described the penalties as savage. Col. Murray opposed the clause requiring registration books to be carried.

Mr. Neal, Parliamentary Secretary to the Ministry, said the car licences, to which a good deal of attention had been paid, would be attached to the car. The registration book would be a history of the car, and should be left at home, though there would be a liability to produce it when required. This would be a severe check on the stealing of motors.

An important point was the question of the control of the motor traffic. As the law at present stood, this was extremely difficult to deal with, and for this reason the Bill had been drawn wide so as to meet the difficulty. As to coaches, which were largely used by persons who could not afford to keep motor cars, they had come to stay, and the Government would not be anxious to interfere with their proper use.

Mr. Hohler said the diversion of the fines received from offending motor drivers from the County Councils to the Government would cause an increase in the police rate.

LEYLAND SERVICE BY AIRPLANE.

At 5.55 p.m. on September 23 a telegram was despatched from Messrs. Schmidt and Yde, Copenhagen, to Leyland Motors, Limited, London, instructing them to ship immediately one set of gear wheels for the gear box of a 2-ton Leyland chassis. The Airco Company were immediately communicated with, and it was found that the next Copenhagen air express would leave Croydon at 10.30 a.m. on September 24, bound in the first place for Amsterdam. A set of gear wheels was accordingly prepared and despatched by fast Leyland lorry to Croydon. The consignment left Croydon at 10.30 a.m. on September 24, and a cable communication from Messrs. Schmidt and Yde notified that the goods arrived at 7.0 p.m. The Leyland lorry for which the gear wheels were ordered was then fitted at the repair shop of Messrs. Schmidt and Yde and was, in the shortest possible time, driven away under its own power. The whole transaction was carried out well inside three days, whereas if the matter had been left to forwarding by steamer, at least two weeks would have been lost.

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MOTOR TRAFFIC

MOTOR VEHICLES FOR MUNICIPALITIES.

MANCHESTER CORPORATION have purchased a 30-40-cwt. Vulcan lorry.

DURHAM COUNTY COUNCIL have obtained a 25-H.P. Vauxhall car at £700.

ILKESTON COUNCIL have purchased a Garnon motor tipping lorry at £855.

LANCASHIRE COUNTY COUNCIL have purchased a 30-cwt. Vulcan tipping wagon at £900.

ILFORD URBAN COUNCIL report delivery of a Thornycroft-Waller vacuum cesspit emptier.

SOUTHAMPTON COUNTY COUNCIL have purchased four cars for the divisional road surveyors.

CHERTSEY URBAN COUNCIL have obtained permission to borrow £1,800 for the purchase of a fire engine.

EDMONTON URBAN COUNCIL have taken delivery of five 2-ton Orwell Electric vehicles for refuse collection.

MANCHESTER PAVING COMMITTEE have found a steam wagon to be so useful that two more have been ordered.

PRESTON WATCH COMMITTEE recommend the purchase of a chassis for a hose carriage at an estimated cost of £1,100.

ESSEX COUNTY COUNCIL propose to obtain three Foden steam wagons at £1,395 each, and two Clayton steam wagons at £1,395 each.

LONDON COUNTY COUNCIL are replacing their horse-drawn tower wagons used by the Tramways department with petrol machines.

HERTFORDSHIRE COUNTY COUNCIL have agreed to pay the principal of the Agricultural College 7½d. a mile when using his own car for county purposes.

DEPTFORD BOROUGH COUNCIL, who have five Halley petrol vehicles, are purchasing another, second hand, from Halley's Industrial Motors, Limited, at £750.

YORK FIRE BRIGADE COMMITTEE reports that the new Dennis fire engine has been received from the makers, and that it has been thoroughly tested and proved satisfactory.

ESSEX COUNTY COUNCIL propose the purchase of motor bicycles as follows for its highway staff—Douglas, with side-car, at £170; Triumph, with side-car, at £157 10s., and a Triumph at £127 10s.

WESTMINSTER CITY COUNCIL have arranged with the Eagle Engineering Company to supply three bodies for Thornycroft chassis at a total cost of £717. The firm sent a specimen body from Warwick.

HACKNEY WORKS COMMITTEE recommend the purchase of a Lacre road-sweeping machine at £650. The committee have had satisfactory reports as to this machine from authorities which are using it.

ROTHERHAM TRAMWAYS COMMITTEE recommend the acceptance of the tender of the Anglo-American Oil Company, Limited, at £295, for constructing an underground tank, with pumping apparatus, necessary for storing two thousand gallons of benzol.

DEVONSHIRE COUNTY COUNCIL, under the new scheme of maintaining the main roads of Devonshire, recommended an expenditure of £70,000 on plant and materials, including twelve steam wagons, twenty-one steam rollers, a one-ton lorry and pump set, three steam tractors and wagons, and thirty-four sleeping vans.

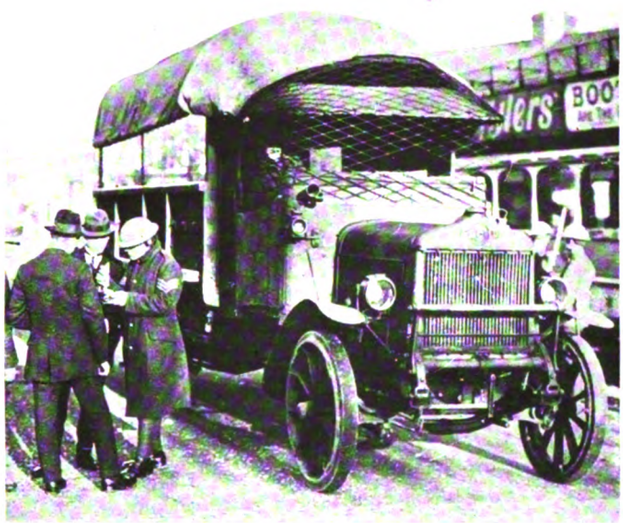
HULL HEALTH COMMITTEE report that the one ambulance now in use has covered 28,000 miles during 2½ years. They advise the purchase of a second motor ambulance. A new motor cycle has been supplied to an officer of the committee, and his old machine has been allotted to the cleansing superintendent.

THE METROPOLITAN ASYLUMS BOARD, finding it too expensive to use a large motor omnibus for conveying passengers to the Darenth Asylum, have decided to get a vehicle to seat four or five. To save the hire of horses at £2 a week per horse, the Board are obtaining a motor lorry for the conveyance of supplies to the river hospitals.

SHEFFIELD CITY SURVEYOR states in his annual report that every possible use is being made of motor appliances. Horse sweeping has long ago been discontinued. Street watering is entirely carried out by motor vans, which at night haul the sweeping machines. Very few horses are employed for the collection of sweepings, most of this work now being done by motor lorries. Experiments have been made with machines to sweep up the roads and at the same time collect the sweepings.

KENT COUNTY COUNCIL have purchased new plant as follows—Six Halford 4-ton petrol lorries, five Aveling and Porter steam tractors with rubber tires, and four trailer wagons with tipping bodies. The Council also possess three Aveling and Porter 4-ton petrol lorries, one Halley 3-ton petrol lorry, and sixteen Aveling and Porter steam tractors. The latter have been in use for over fifteen years, and the county surveyor reports that at no distant date they will have to be replaced by new machines.

GLASGOW CLEANSING COMMITTEE, who recently arranged for the Scottish Electric Vehicle Company to supply the chassis of four electric vehicles, have now arranged that the Company shall also supply the tipping bodies, the cost per complete vehicle being £1,342. The Corporation recently appointed a sub-committee to consider the question of promoting the use of electricity for motor vehicles. This sub-committee now propose the purchase of an electric passenger vehicle for the electricity department, at a cost not exceeding £1,100. The Corporation propose to make regulations to secure every economy in the use of departmental cars. The garage committee are considering a system of cards for issue to chauffeurs showing the name of councillor or official using the car, time of order and return of car to garage, etc.



A.E.C. Lorry in the Irish "War"
(Fitted with Wire Screen as a Protection for the Driver).

SIR R. DENNIS'S WORLD TOUR.

In addressing the shareholders of Dennis Brothers, at their annual meeting on November 30, Mr. N. P. Andrew (chairman) read a letter from Sir Raymond Dennis, who was on a 12 months' world tour in the interests of the company, in which he stated that the results had exceeded his most sanguine expectations. He was the first managing director of any British motor manufacturing firm to make a world tour since the war in his firm's interests, and to this might be attributed, in part, the fact that he had been able to secure the very best representation for their production in all the countries he had so far visited.

The chairman added that Mr. Poppe and Mr. Charles, two of their expert directors, had gone to America for the purpose of investigating the most up-to-date manufacturing methods in that country.

Reviewing the year's working, the chairman remarked that the new 2-ton model, which should have been ready to deliver in quantities in the spring of this year, but which, unhappily, was not ready until August, owing to the moulders' strike, was a pronounced success.

LEEDS CORPORATION MOTORS.—Leeds Tramways Committee have agreed that the charge for the use of Corporation motor cars be increased to the rate of 15s. per hour provided that any distance beyond 15 miles travelled within the hour be charged for at the rate of 1s. 6d. per mile.

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MOTOR TRAFFIC

MOTOR TRAFFIC NOTES.

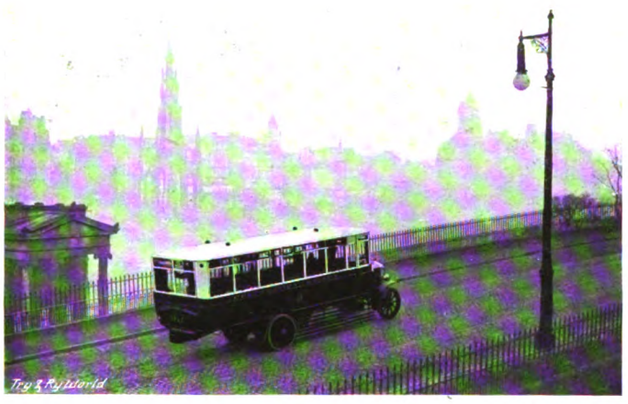
ROUTE CONTROL OF HEAVY VEHICLES.—Grimsby Corporation are seeking powers from Parliament to prevent heavy vehicles using certain streets.

COMMER CARS IN ADELAIDE.—An order for a further nineteen Commer cars has been placed by the Metropolitan Abbatoir Board of Adelaide, who have had twenty-two 6-ton Commer cars in operation since 1912.

COMPULSORY MIRRORS.—The County Councils Association are seeking the views of county authorities as to making compulsory the use of reflectors on motor vehicles to enable drivers to see if vehicles are overtaking them.

PREVENTION OF MUD SPLASHING.—Camberwell Borough Council report that owing to the difficulties which have arisen they have postponed the demonstration of inventions to prevent mud splashing to a date in January, 1921, to be afterwards fixed.

SUBSCRIPTIONS AND EXCESS PROFITS DUTY.—The Commercial Motor Users' Association announce that the Board of Inland Revenue have informed them that subscriptions paid by members will be allowed as a deduction in computing liability to excess profits duty.



One of the A.E.C. Omnibuses Replacing Cable Cars on The Mound, Edinburgh.

REGISTRATIONS IN KENT.—During the year ended September 30 last, there were registered in Kent 53 agricultural engines as compared with 34 in the preceding year; 2,157 heavy cars, an increase for the year of 835; and 26,372 ordinary cars and motor cycles, an increase of 4,303.

OFFICIAL MOTOR ALLOWANCES.—The Ministry of Health have sanctioned travelling allowances for registration officers on the following scale—Ordinary cycle, 2d. a mile; horse and trap, 6d. a mile; motor cycle, 3½d. a mile; motor cycle with side car or light car under 7 H.P., 4½d.; motor cars varying from 6d. to 9d.

CENSUS OF NARROW ROADS.—West Sussex county surveyor has communicated with the various local authorities with a view to the compilation of a schedule of roads throughout the county deemed to be too narrow for heavy motor and coach traffic. The idea is to get the Ministry of Transport to declare such narrow roads as dangerous.

NEW TRAFFIC BY-LAW PROPOSED AT MANCHESTER.—The Watch Committee propose to have inserted in the next Parliamentary Bill a by-law requiring all overtaking traffic on the near side to come to a standstill when a tramcar is taking-up or setting-down passengers. The local associations of vehicle owners are strongly opposing the proposal.

A DAIMLER WORKS FILM.—With a view to bringing before British manufacturers the value of the film in the development of foreign trade, the Department of Overseas Trade on November 17 gave an exhibition of industrial and advertising films at Hull. The most notable exhibit portrayed the processes of manufacture of cars at the works of the Daimler Motor Car Company.

VEHICLES PASSING TRAMWAY CARS IN HULL.—The Hull Board of Guardians have asked the Corporation to obtain by-laws prescribing either a complete stoppage or a low rate of speed for all vehicles passing tramway cars on the near side while cars are taking up or setting down passengers. The Watch Committee have replied that there are considerable difficulties in the way of making effective by-laws.

TRAFFIC RULES AND RECOMMENDATIONS.—The Commercial Motor Users' Association have issued a revised edition of traffic rules and recommendations. The publication has been approved by the Metropolitan Police, and is issued in a form suitable for carrying in a driver's licence. A copy will be forwarded post free on application to Mr. F. G. Bristow, general secretary, 50, Pall Mall, London, S.W.1.

RULES FOR DRIVERS.—Essex County Council have asked their Highways Committee to consider the following suggestion—That with regard to motor drivers' licences the driver shall be expected to know the ordinary rules of the road, and that a copy of such rules be printed in his licence book, and that the driver of a char-a-bancs shall give a signal for an approaching motor to pass, to show that he has heard the signal from behind.

AVERAGE HOURLY WORKING COST.—A Kent County Council return shows that the average hourly cost of working a steam roller, including repairs, coal, oil, waste, scarifying tires, insurance, driver and attendant was, last year, 4s. 11½d.; that of a steam motor, including all charges, 6s. 1d.; petrol heavy motor, 6s. 4d., and a Foden lorry 6s. 4d. Bedfordshire County Council have been recommended by the Roads Committee to raise the charge for hiring by the local authorities of road rollers to £3 a day for steam rollers, and £3 5s. a day for petrol rollers. At present only £1 8s. a day is charged..

TREATMENT OF KENT MAIN ROADS.—In Kent, the surfacing of roads with a carpet of bitumen and sand mixture 1½ inches thick laid on specially prepared base coat of local materials treated with pitch and tar, both coatings laid hot, has been considerably extended. This class of work has been confined to most important and heavily used sections, including the London-Dover, London-Folkestone, and Maidstone-Tonbridge main roads. Highways similarly treated in previous years are declared to have withstood intense traffic extremely well and fully justified the continuation of this system of surfacing.

THE WIDTH OF LORRY LOADS.—At Ripon police court on November 26, Messrs. Whitaker, Ltd., of Leeds, were fined £5 on each of two summonses for permitting heavy motor vehicles to be driven on the highway carrying material over the regulation width, and their two drivers were ordered each to pay £1. The load comprised sections of army huts, and the police evidence was to the effect that heavy motor vehicles of three tons or over must not exceed 7 ft. 6 in. in width. In one instance the load had a width of 10 ft. 10 in., and in the other 9 ft. 6 in. For the defence it was urged that the Order made no reference to the width of loads. The Bench agreed to state a case for appeal.

DERELICT LORRIES FROM FRANCE.—The haulage and conveyance of thousands of lorries from France, via Richborough, to Slough, which continued from August, 1919, to April, 1920, did great damage to the main roads. In Kent it is recorded that nearly ten thousand derelict lorries and two thousand cars were towed or carried over 65 miles of main roads, and the towing chassis made 23,498 journeys. The total weight passing over the roads was approximately 128,500 tons. The County engineer reports that the railway strike undoubtedly caused many additional commercial vehicles to be placed permanently on the roads. The omnibus traffic for regular services between most of the towns and villages in the county, including those running out of London even as far as the coast and coach traffic is ever on the increase, as is also the number of light cars.

THREE-COUNTY OMNIBUS SCHEME.—In a letter to the Herts. County Council, Sir H. Maybury, director of roads, says that although Parliament did not sanction the Bill promoted by the London, Middlesex, and Herts. County Councils for running omnibuses under mutual agreements, the understanding arrived at by the three authorities marks a very important advance in local government, more particularly as in the past it has been anything but easy for local authorities to come to agreements in matters of this kind. It is to be hoped, he says, that the amicable arrangement arrived at will constitute a precedent. Herts. County Council have also received a letter from the London County Council expressing the hope that the agreement which led to the promotion of the Bill may result in closer co-operation in the future, especially with regard to the solution of traffic problems

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SEPTEMBER 16, 1920
Vol. XLVIII., No. 14
WITH
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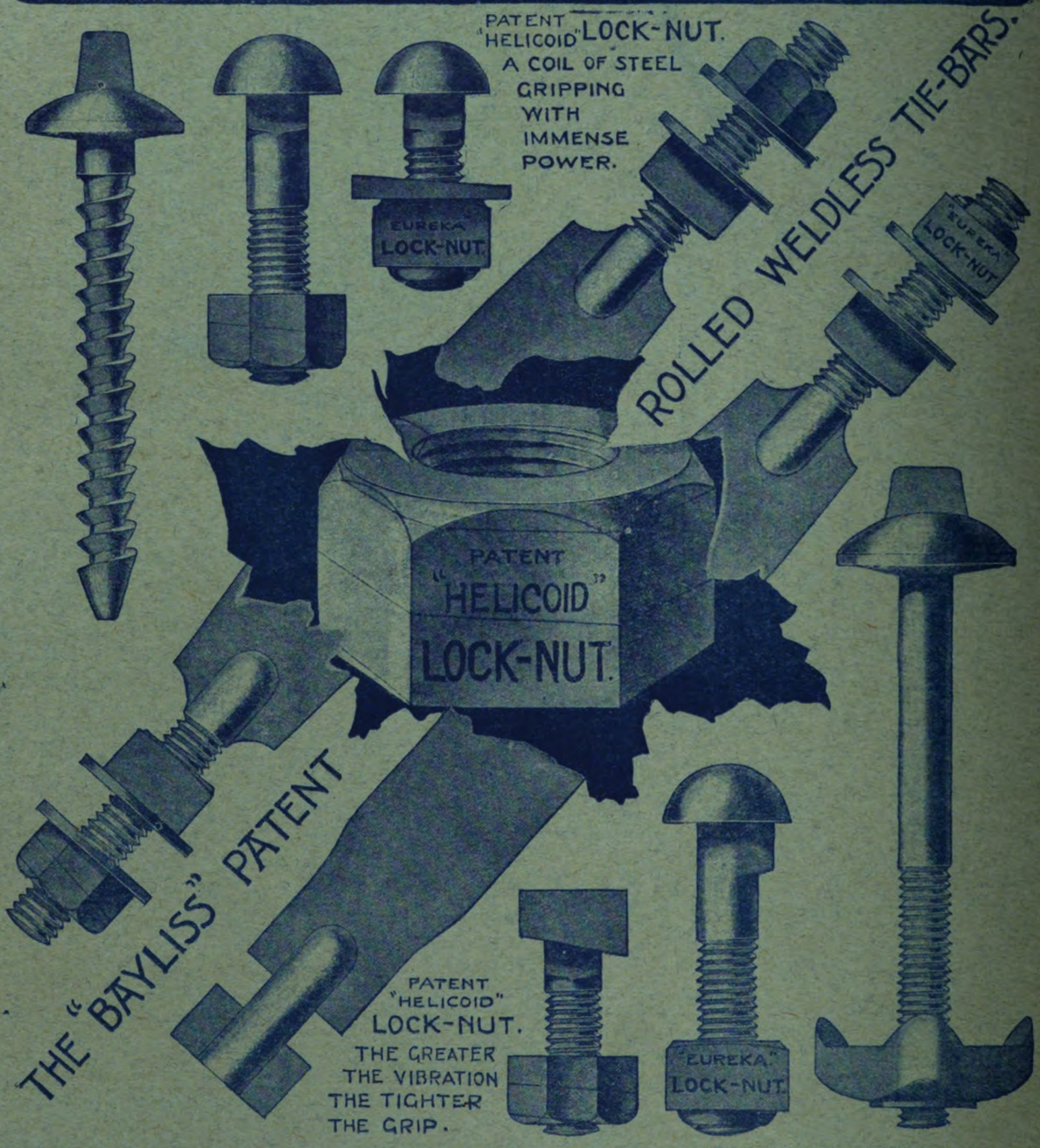

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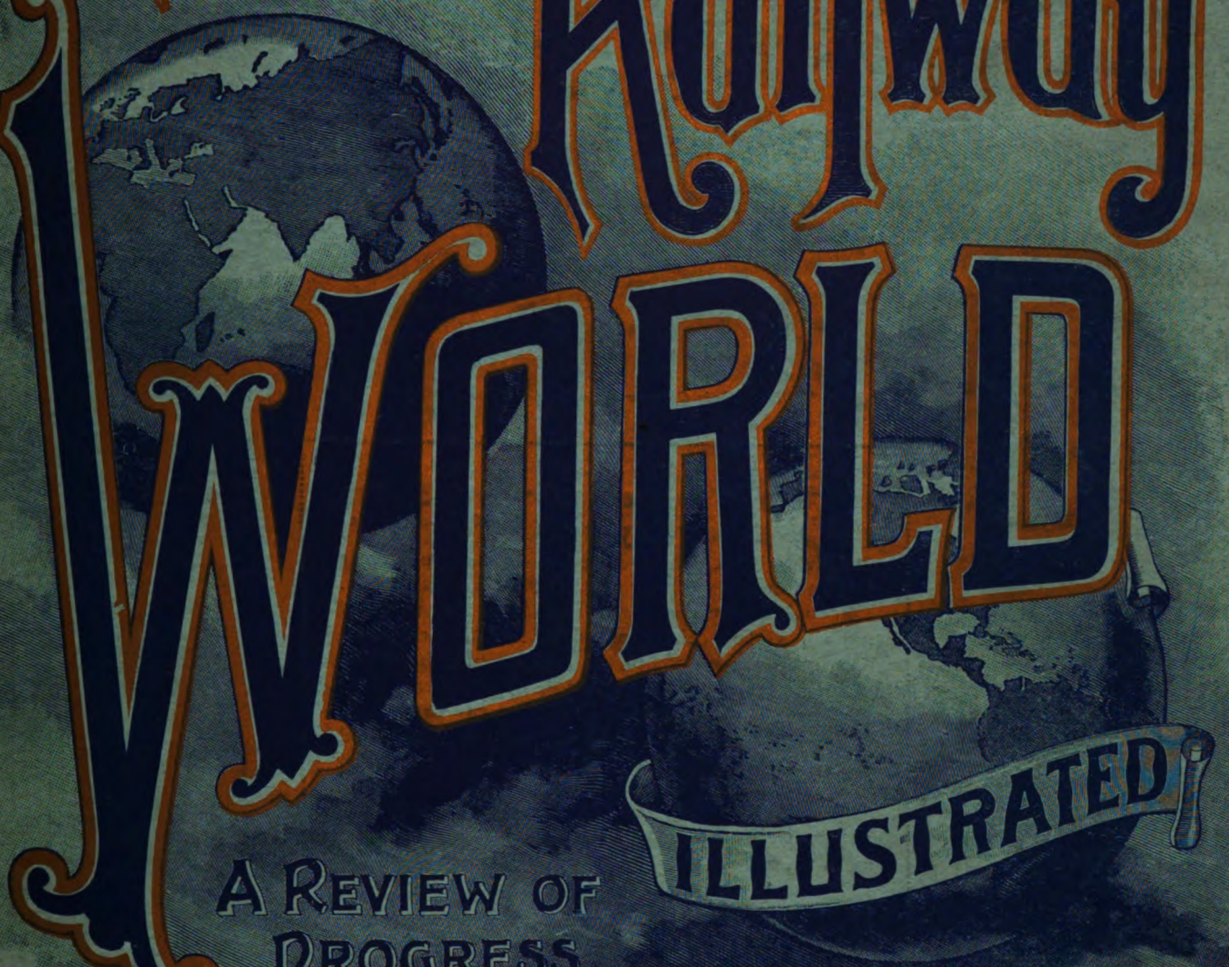

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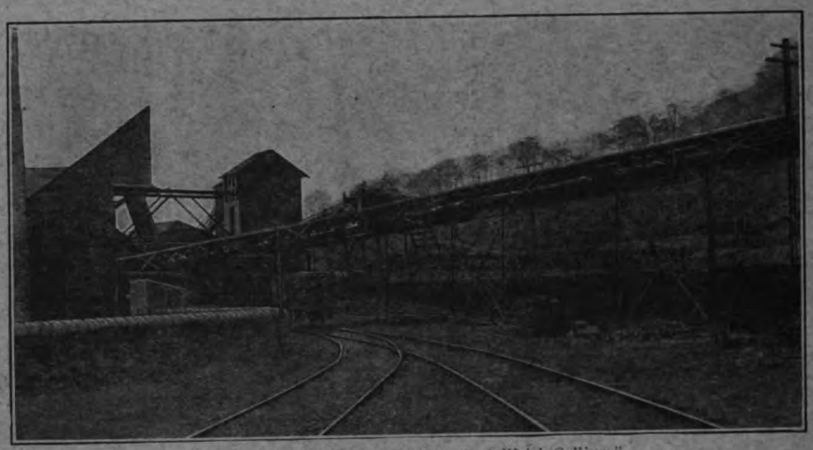

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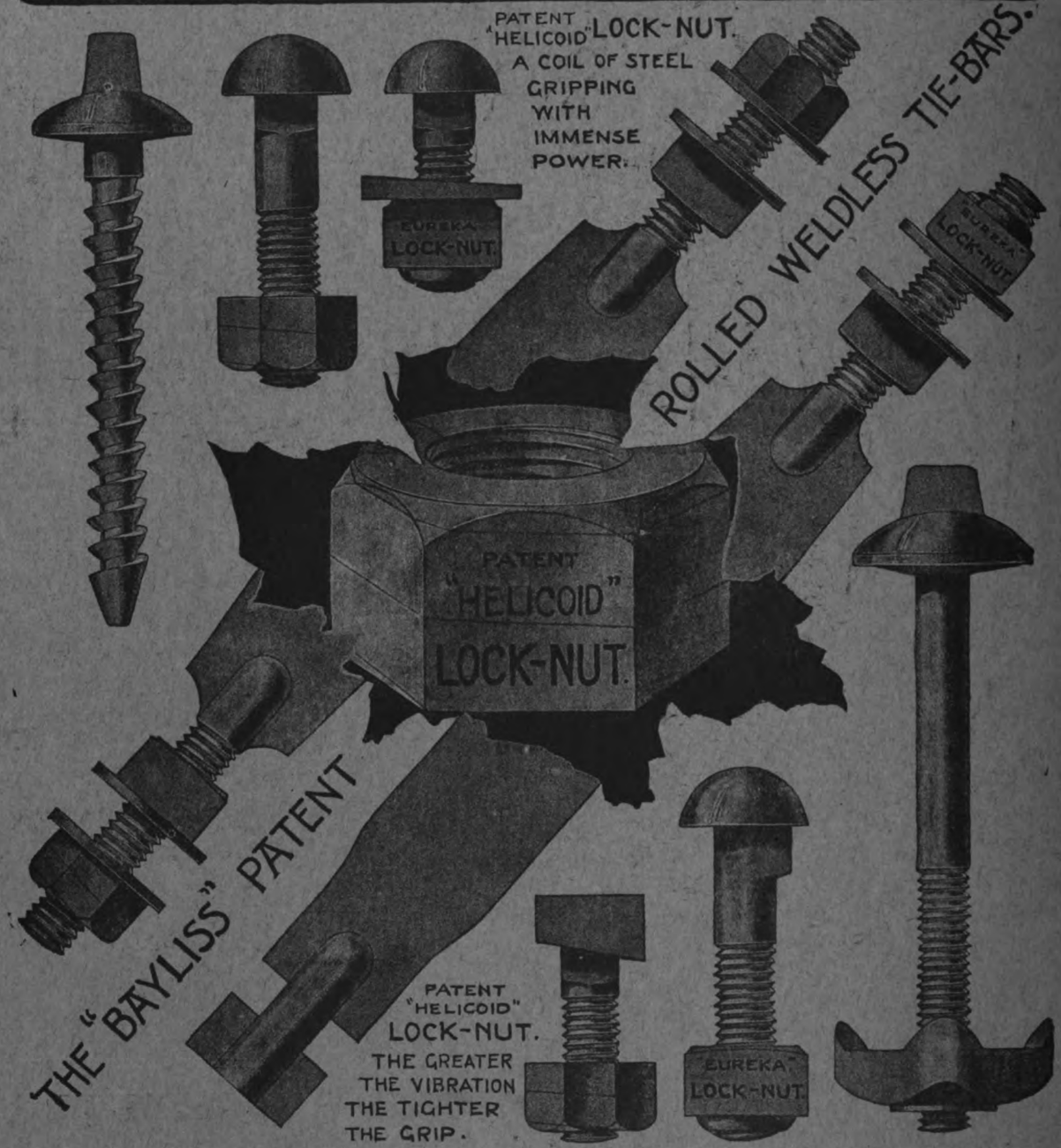

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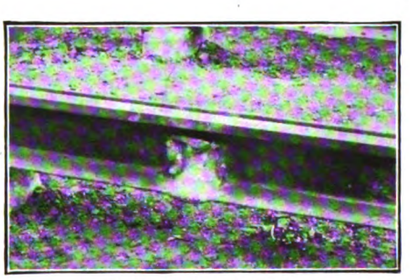

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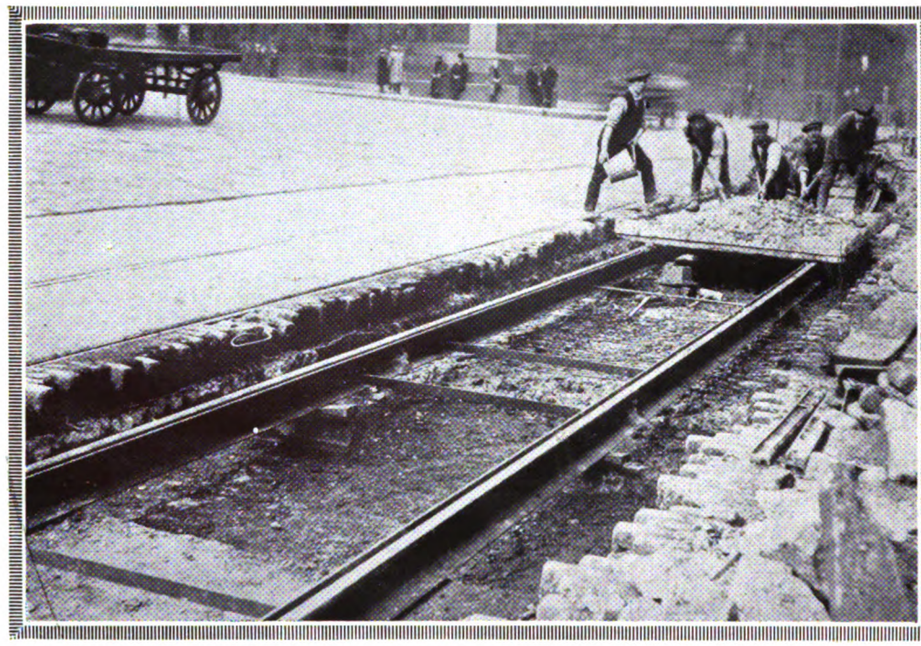

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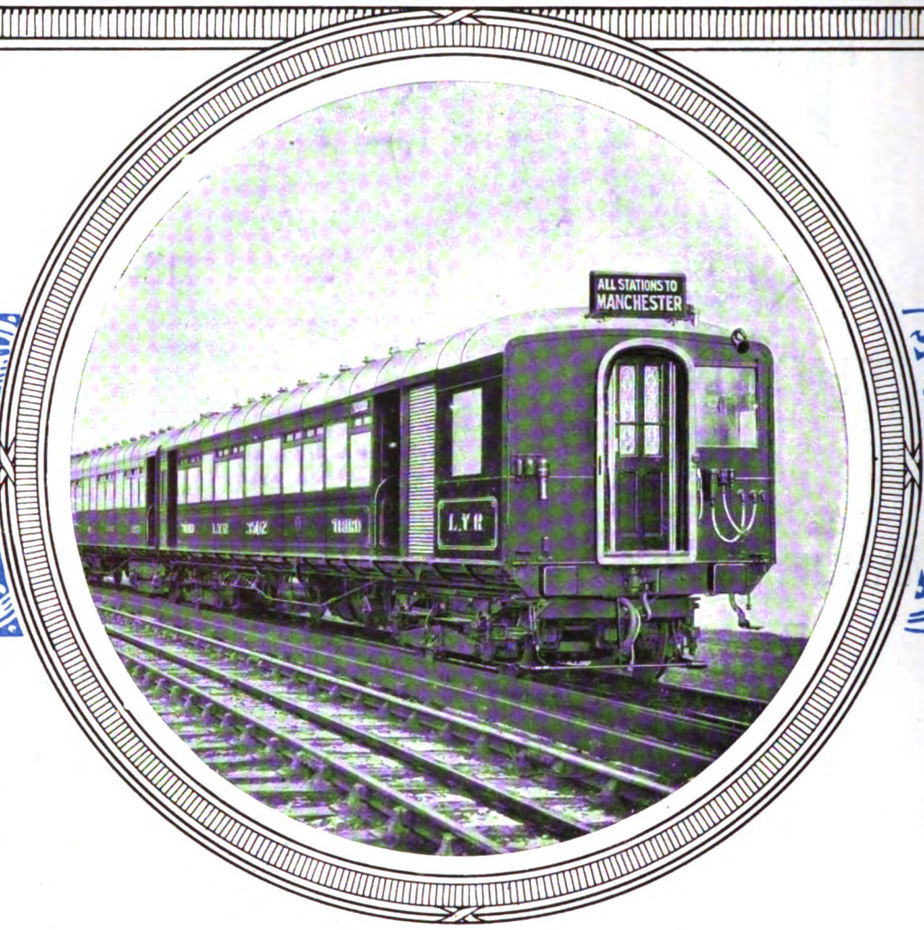

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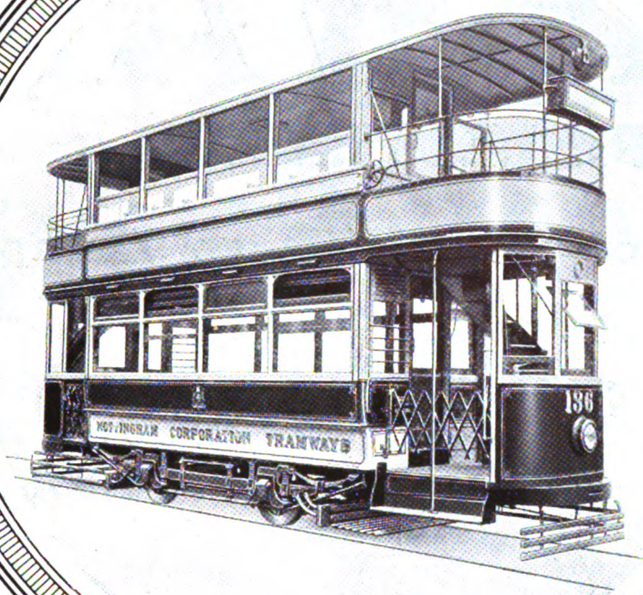

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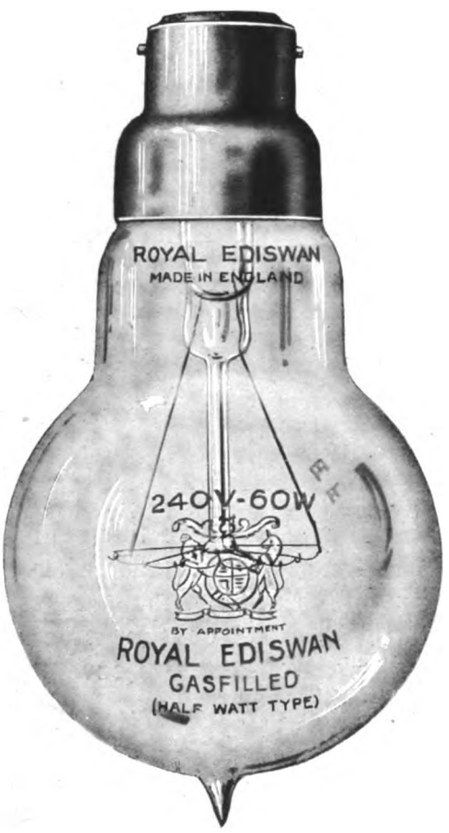

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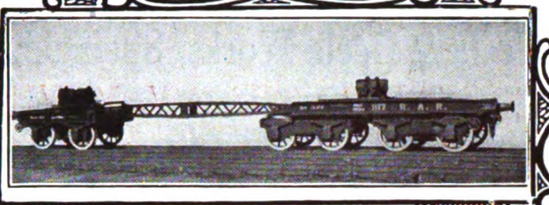

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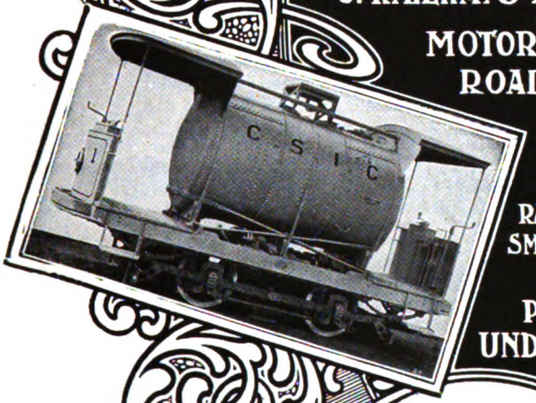

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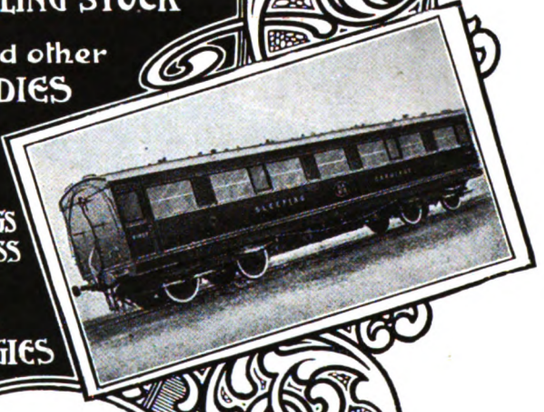

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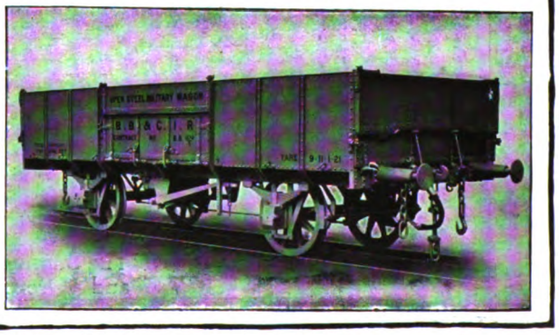

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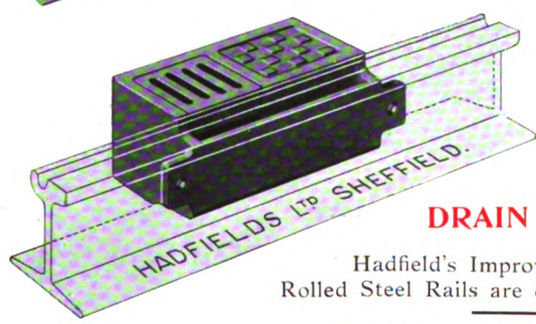

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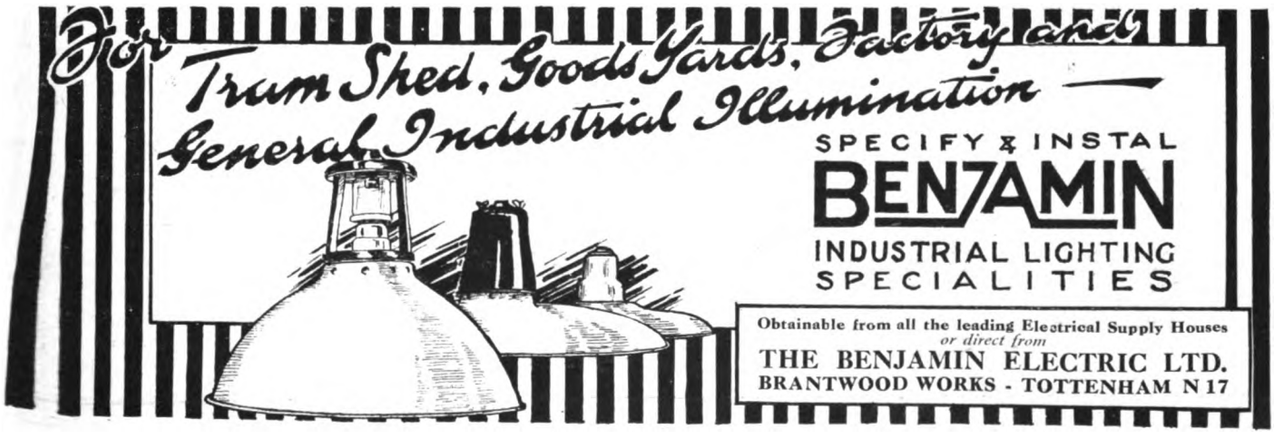
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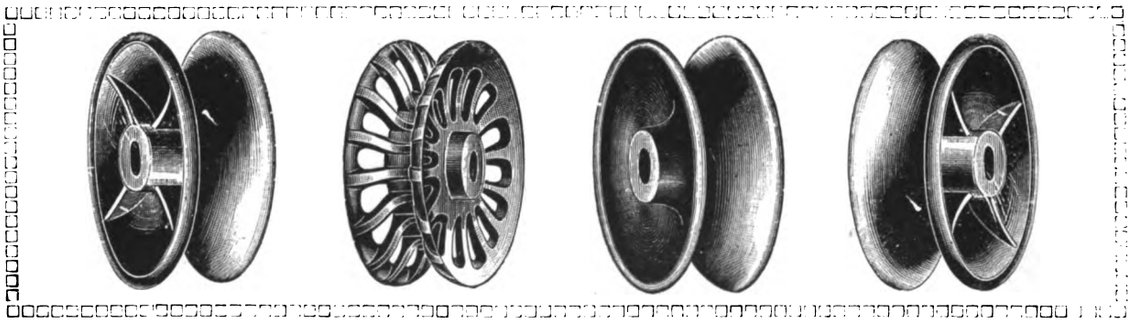

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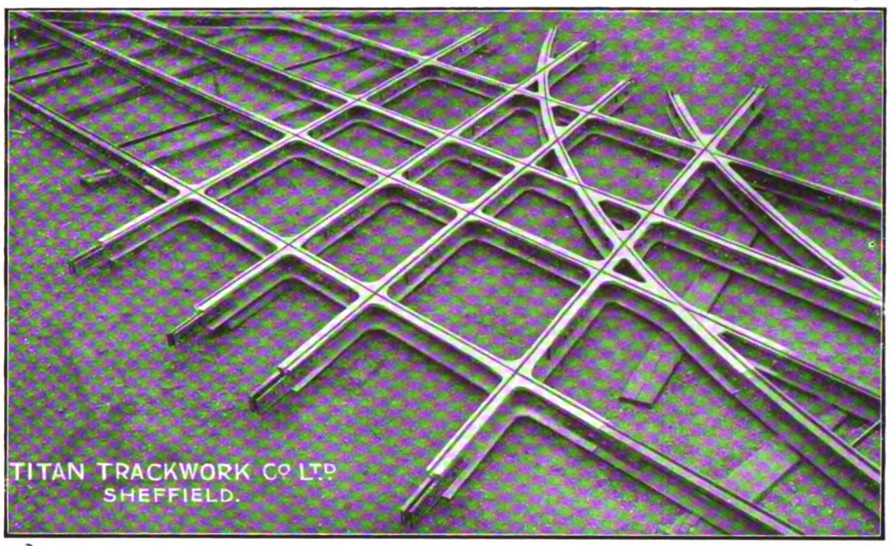

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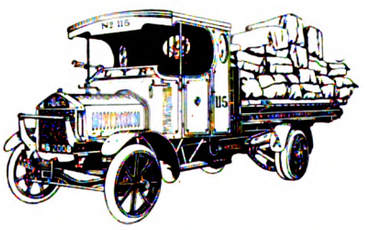

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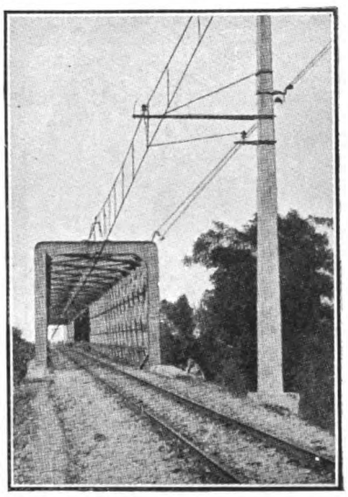

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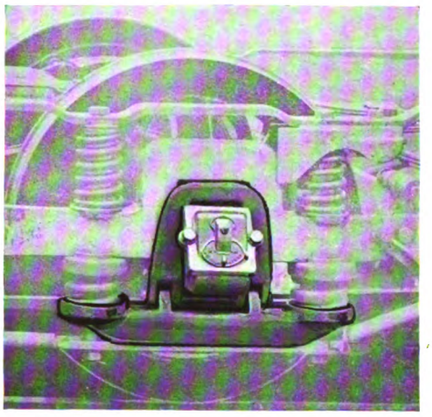

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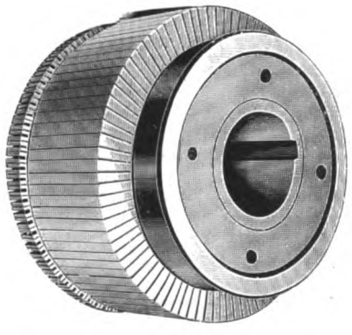

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Fleming, Birkby & Goodall, Ltd., Liversedge.
Henley's Telegraph Works Co., Ltd., London.
Metropolitan-Vickers Elec. Co., Manchester.
Tramway Supplies, Ltd., Leeds.
Williams & Pell, London, W.C.
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IRONWORK FOR CAR BODIES.
Brockhouse, J., & Co., Ltd., West Bromwich.

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Hadfields, Ltd., Sheffield.

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Allen, Edgar, & Co., Ltd., Sheffield.
Rail Welding Co., London, W.
Thermit, Limited, London, E.C.

JOURNAL BOXES.
Brill Company, J. G., London, S.W.
Peckham Truck and Eng. Co., London, E.C.

JOURNAL BOX PACKING.
Beckett, Laycock & Watkinson, Ltd., London.
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General Seating Co., Ltd., London, S.W.

LAMPS, ELECTRIC.
Britannia Lamp & Accessories Co., London.
British Thomson-Houston Co., Ltd., Rugby.
English Electric Co., Ltd., London, W.C.
Metropolitan-Vickers Elec. Co., Manchester.

LEATHERS (UPHOLSTERY).
General Seating Co., Ltd., London, S.W.

LIFTING JACKS.
Brill Company, J. G., London, E.C.
Duff Jack Sales Co., Ltd., London, W.
Equipment & Engineering Co., London, W.C.
Peckham Truck and Eng. Co., London, E.C.

LIGHTNING ARRESTERS.
Britannia Lamp & Accessories Co., Ltd., E.C.
British Thomson-Houston Co., Ltd., Rugby.
English Electric Co., Ltd., London, W.C.
Equipment & Engineering Co., London, W.C.
Metropolitan-Vickers Elec. Co., Manchester.

LINCRUSTA WALTON.
General Seating Co., Ltd., London, S.W.

LINE MATERIAL, ELECTRIC TRAMWAY
Britannia Lamp & Accessories Co., London.
British Thomson-Houston Co., Ltd., Rugby.
Electro-Mechanical Brake Co., W. Bromwich
English Electric Co., Ltd., London, W.C.
Equipment & Engineering Co., London, W.C.
Fleming, Birkby & Goodall, Ltd., Liversedge.
Green, Geo. W., & Co., Ltd., Feltham.
Henley's Telegraph Works Co., Ltd., London.
Plumpton, Herbert, Ltd., Warrington.
Standard Underground Cable Co., London.
Tramway Supplies, Ltd., Leeds.
Wiseman, Alfred, Ltd., Birmingham.

LOCK WASHERS.
Britannia Lamp & Accessories Co., Ltd., E.C.
Equipment & Engineering Co., London, W.C.

LOCOMOTIVES.
British Thomson-Houston Co., Ltd., Rugby.
English Electric Co., Ltd., London, W.C.
Metropolitan-Vickers Elec. Co., Manchester.

LORRIES.
Associated Equipment Co. Ltd., London, E.
Clayton & Co. Huddersfield, Ltd., Huddersf'ld.
Leyland Motors, Ltd., Leyland, Lancs.

LUBRICATING OILS.
Dick, W. B., & Co., Ltd., London, E.C.

METALS
British Aluminium Co., Ltd., London, E.C.
Hoyt Metal Co., Ltd., London, W.C.

MILLBOARDS—"PANELLIUM."
General Seating Co., Ltd., London, S.W.

MOTOR OMNIBUSES.
Associated Equipment Co. Ltd., London, E.
Clayton & Co. Huddersfield, Ltd., Huddersf'ld.
Leyland Motors, Ltd., Leyland, Lancs.

MOTOR VEHICLES.
Associated Equipment Co. Ltd., London, E.
Clayton & Co Huddersfield, Ltd., Huddersf'ld.
Leyland Motors, Ltd., Leyland, Lancs.
Thornycroft, John I. & Co. Ltd., London.

MOVABLE CAR STEPS.
Equipment & Engineering Co., London, W.C.

OVERHEAD EQUIPMENT. (See Line Material.)

OVERHEAD LINE TOOLS.
Britannia Lamp & Accessories Co., Ltd., E.C.
Plumpton, Herbert, Ltd., Warrington.

PAINT.
Docker Bros., Ltd., London.
Kearsley, Robert, & Co., Ltd., Ripon, Yorks.

PANELS, ALUMINIUM.
British Aluminium Co., Ltd., London, E.C.

PERMANENT WAY TOOLS.
Allen, Edgar, & Co., Ltd., Sheffield.

PISTON RINGS.
Allen & Simmonds, Ltd., Reading.

POINTS AND CROSSINGS.
Allen, Edgar, & Co., Ltd., Sheffield.
English Electric Co., Ltd., London, W.C.
Hadfields, Ltd., Sheffield.
Lorain Steel Company, London.
Titan Trackwork Co., Ltd., Sheffield.

POINT CONTROLLERS.
Equipment & Engineering Co., London, W.C.
Tramway Supplies, Ltd., Leeds.

POLES, METAL.
Britannia Lamp & Accessories Co., E.C.
English Electric Co., Ltd., London, W.C.
Equipment & Engineering Co., London, W.C.
Stewarts & Lloyds, Ltd., Glasgow.
Tramway Supplies, Ltd., Leeds.

PRESSWORK PARTS.
Terry & Sons, Ltd., Herbert, Redditch.

PUBLIC SERVICE VEHICLES.
Clayton & Co Huddersfield, Ltd., Huddersf'ld.

PUNCHES, TICKET.
Auto-Ticket Printing Co., Ltd., Liverpool.
Bell Punch & Printing Co., Ltd., London.
Williamson, Alfred, Ashton-under-Lyne.

RAIL BONDS.
Britannia Lamp & Accessories Co., Ltd., E.C.
Equipment & Engineering Co., London, W.C.
Peckham Truck and Eng. Co., London, E.C.
Tramway Supplies, Ltd., Leeds.

RAIL GRINDERS.
Equipment & Engineering Co., London, W.C.
Peckham Truck and Eng. Co., London, E.C.
Thermit, Ltd., London, E.C.
Tramway Supplies, Ltd., Leeds.
Woods-Gilbert Rail Remodelling Co., London

RAIL JOINTS.
Hadfields, Ltd., Sheffield
Rail Welding Co., London, W.
Thermit, Limited, London, E.C.
Woods-Gilbert Rail Remodelling Co., London

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English English Co., Ltd., London, W.C.
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(Continued on page xx.)

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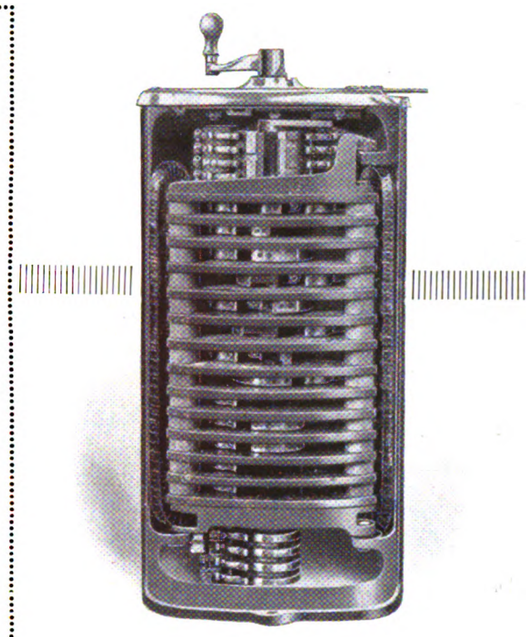

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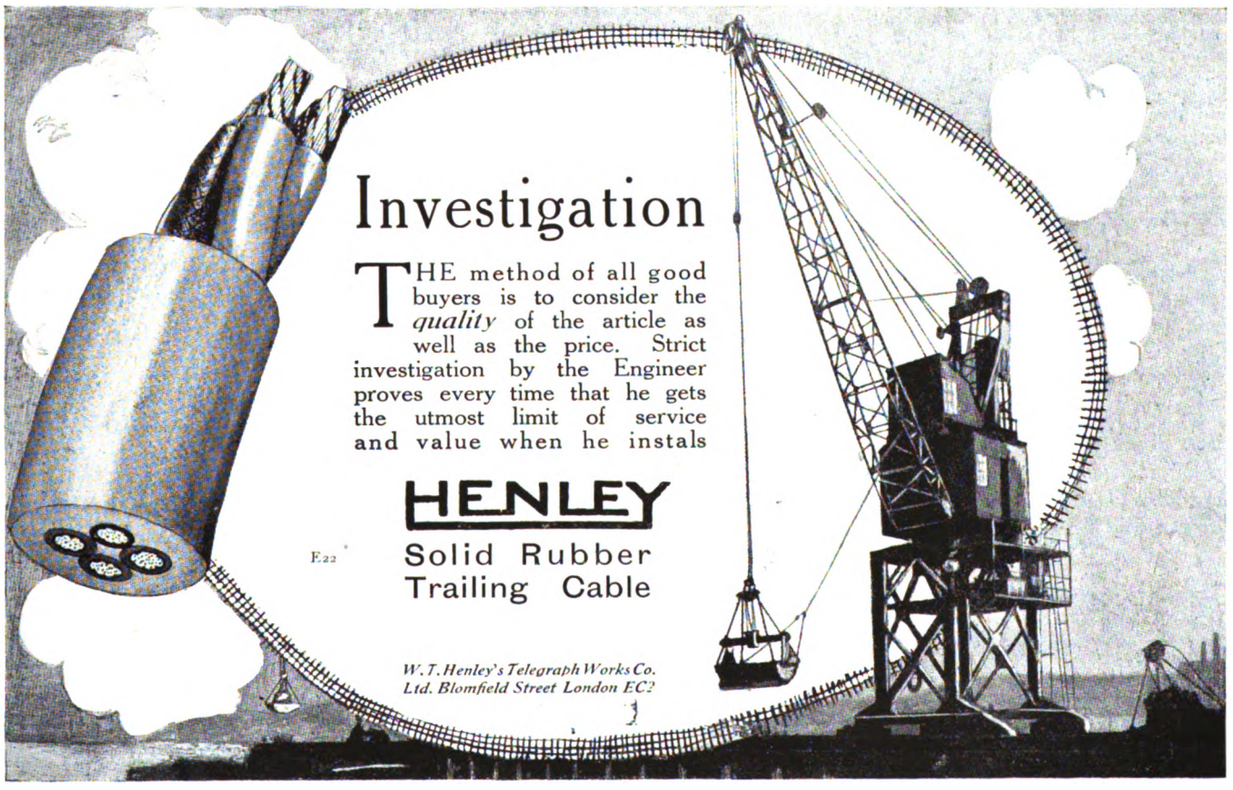
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Hadfields, Ltd., Sheffield.
Lorain Steel Company, London.
Titan Trackwork Co., Ltd., Sheffield.

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British Thomson-Houston Co., Ltd., Rugby.
English Electric Co., Ltd., London, W.C.
Metropolitan-Vickers Elec. Co., Manchester.

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General Seating Co., Ltd., London, S.W.
Yates & Co., Ltd., John, Aston Manor.

RATTAN.
Brill Company, J. G., London, E.C.
General Seating Co., Ltd., London, S.W.

RESISTANCES.
Electro-Mechanical Brake Co., W. Bromwich.
English Electric Co., Ltd., London, W.C.

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Empire Roller Bearings Co., London, S.W.

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Equipment & Engineering Co., London, W.C.
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Brill Company, J. G., London, S.W.
English Electric Co., Ltd., London, W.C.
Equipment & Engineering Co., London, W.C.
Tramway Supplies, Ltd., Leeds.

SAND DRYERS.
Equipment & Engineering Co., London, W.C.
Tramway Supplies, Ltd., Leeds.

SEATS AND SEATING MATERIALS.
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English Electric Co., Ltd., London, W.C.
Equipment & Engineering Co., London, W.C.
General Seating Co., Ltd., London, S.W.

SIDE GUARDS.
Equipment & Engineering Co., London, W.C.

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Equipment & Engineering Co., London, W.C.

SNOW PLOWS.
Brill Company, J. G., London, S.W.

SPRINGS.
Allen, Edgar, & Co., Ltd., Sheffield.
Anger Manufacturing Co., Ltd., Preston.
Brill Company, J. G., London, E.C.
Hadfields, Ltd., Sheffield.
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English Electric Co., Ltd., London, W.C.

STEAM TURBINES.
British Thomson-Houston Co., Ltd., Rugby.
English Electric Co., Ltd., London, W.C.
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Metropolitan-Vickers Elec. Co., Manchester.

STEAM WAGONS.
Leyland Motors, Ltd., Leyland, Lancs.

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Brill Company, J. G., London, E.C.
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Hadfields, Ltd., Sheffield.

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Allen, Edgar, & Co., Ltd., Sheffield.

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English Electric Co., Ltd., London, W.C.

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British Thomson-Houston Co., Rugby.
Edison Swan Electric Co., Ltd., Ponders End, Middlesex.
English Electric Co., Ltd., London, W.C.
Johnson & Phillips, Ltd., Charlton, S.E.
Metropolitan-Vickers Elec. Co., Manchester.
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SWITCHES, ELECTRICAL.
British Thomson-Houston Co., Ltd., Rugby.
Edison Swan Electric Co., Ltd., Ponders End, Middlesex.
English Electric Co., Ltd., London, W.C.
Johnson & Phillips, Ltd., Charlton, S.E.
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Wiseman, Alfred, Ltd., Birmingham.

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Equipment & Engineering Co., London, W.C.
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Clayton & Co. Huddersfield, Ltd., Huddersf'ld.
Equipment & Engineering Co., London, W.C.
Leyland Motors, Ltd., Leyland, Lancs.
Tramway Supplies, Ltd., Leeds.

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Electro-Mechanical Brake Co., W. Bromwich.
English Electric Co., Ltd., London, W.C.
Equipment & Engineering Co., London, W.C.
Tramway Supplies, Ltd., Leeds.

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Brill Company, J. G., London, S.W.
Equipment & Engineering Co., London, W.C.
Tramway Supplies, Ltd., Leeds.

TRACK TOOLS AND APPLIANCES.
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TRUCK BRAKES.
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Brill Company, J. G., London, S.W.
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English Electric Co., Ltd., London, W.C.
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Pinchin, Johnson, & Co., Ltd., London, E.C.

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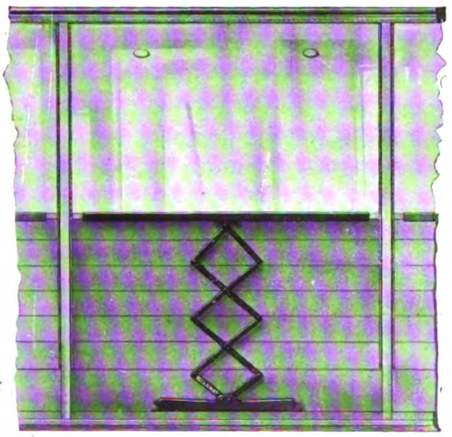

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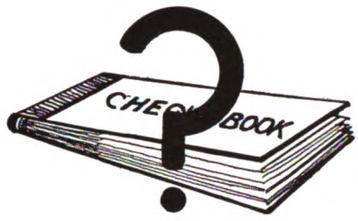

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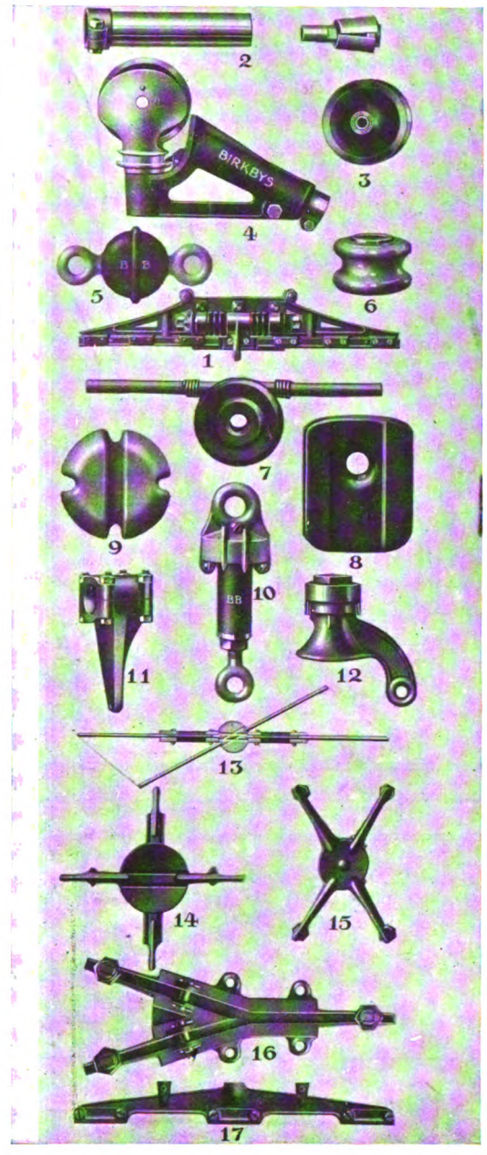

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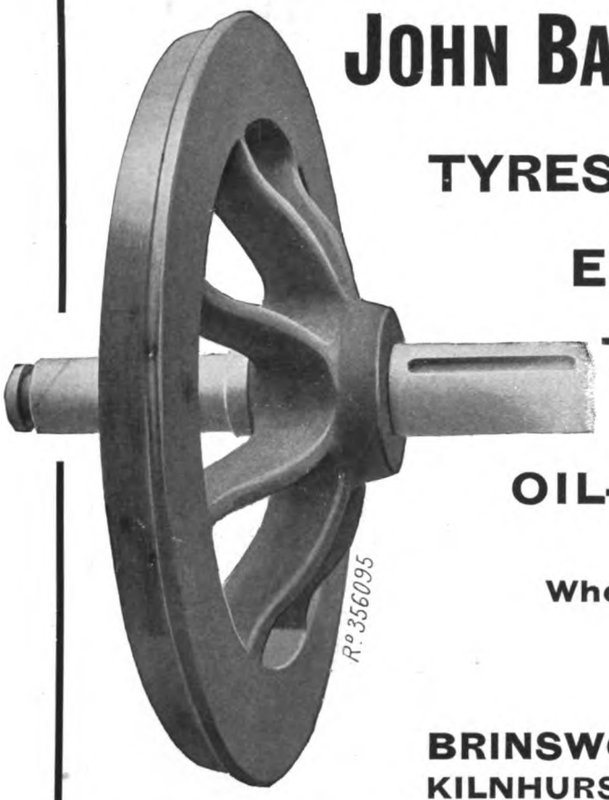

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IN THE UNITED KINGDOM

Municipal Tramways pp. xxiii-xxiv. Company Tramways pp. xxiv-xxviii. Tramway Associations p. xxviii.

NAMES OF PRINCIPAL OFFICERS
POSTAL ADDRESS, TELEGRAPHIC ADDRESS, AND TELEPHONE NUMBERS

***** In order that these Directories may be kept up to date, it is specially requested that intimation of all changes be sent promptly.**

Aberdare Urban District Tramways, Gadlys Estate, Aberdare. [T.A., Tramways, Aberdare: T.N., 17.] *Gen. Manager and Elec. Engineer*, A. J. Abraham; *Traffic Supt.*, H. King; *Chairman Try. Com.*, Coun. E. Stonelake.

Aberdeen Corporation Tramways, Municipal Buildings, Union Street, Aberdeen. [T.A., Trams, Aberdeen; T.N. 826.] *Gen. Manager and Eng.*, W. Forbes; *Per. Way Eng.*, J. Gordon (*Burgh Surveyor*); *Chairman Try. Com.*, Coun. D. W. Beaton.

Accrington Corporation Tramways, Market Hall, Accrington. [T.A., Trams, Accrington; T.N., 2212.] *Gen. Manager and Eng.*, H. Pilling; *Per. Way Eng.*, W. J. Newton; *Chairman Try. Com.*, Ald. T. E. Higham; *Vice-Chairman*, Coun. F. Lord.

Ashton-under-Lyne Corporation Tramways, Tramway Depot, Mossley Road, Ashton. [T.A., Tramways, Ashton; T.N., 325.] *Gen. Manager*, Ernest Holt; *Elec. Eng.*, N. Appelbee; *Chairman Try. Com.*, Ald. R. S. Oldham; *Vice-Chairman*, Ald. C. H. Waterhouse.

Ayr Corporation Tramways, Town Building, Ayr. [T.A., Trams, Ayr; T.N., 128.] *Gen. Manager and Eng.*, William Grant; *Burgh Elec. Eng.*, R. Marshall; *Per. Way Eng.*, John Young; *Rolling Stock Supt.*, Alf. Somerville; *Convener Try. Com.*, Baillie J. Smith; *Vice-Chairman*, Coun. T. Murray.

Bacup Corporation Tramways.—Town Hall, Bacup, Lancs. [Lines leased to and worked by Rawtenstall Corporation.] *Town Clerk*, J. Entwistle; *Boro' Eng.*, G. Bradley; *Chairman Try. Com.*, Coun. S. McLerie; *Vice-Chairman*, Coun. J. H. Lord.

Barking Town Urban District Tramways, East Street, Barking. [T.N., 156 East Ham.] *Eng. and Manager*, W. Holmes; *Acting Engineer and Manager*, W. E. Kidner; *Chairman Try. Com.*, Coun. A. Whiting.

Barrow Corporation Tramways, Salthouse Road, Barrow-in-Furness. *Manager*, J. R. Groves.

Barton-upon-Irwell District Council Light Railways, Barton-upon-Irwell.
[Line leased to and worked by the Lancashire United Tramways Co., *q.v.*]

Batley Corporation Tramways, Batley, Yorks. *Engineer*, S. D. Jones; *Chairman Try. Com.*, Coun. F. W. H. Auty; *Vice-Chairman*, Coun. J. E. Oldroyd.
[Lines leased to and worked by the Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

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Bexley Urban District Council Tramways and Dartford Light Railways. Broadway, Bexleyheath, Kent. [T.A., Makin, Tramways, Bexley; T.N., 79.] *Gen. Manager and Elec. Eng.*, J. Makin; *Chairman Try. Com.*, Coun. W. H. Monk.

Birkenhead Corporation Tramways, Laird Street, Birkenhead. [T.A., Tramways Manager, Birkenhead; T.N., 1110.] *Gen. Manager*, C. Clarke; *Borough Sur. and Eng.*, C. Brownridge; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Coun. H. Halsall; *Vice-Chairman*, Ald. S. Vaughan.

Birmingham Corporation Tramways, The Council House, Congreve Street, Birmingham. [T.A., Trams, Birmingham; T.N., Central 7,000.] *Gen. Manager*, A. Baker; *Elec. Engineer*, A. C. Baker; *Traffic Supt.*, J. McDonnell; *Per. Way Eng.*, C. E. S. Bill; *Chief Engineer*, R. H. Dickinson; *Car Works Supt.*, T. C. Winfield; *Chairman Try. Com.*, Coun. W. E. Lee.

Blackburn Corporation Tramways, Tramways Office, Blackburn. [T.A., Tramways, Blackburn; T.N., 4321.] *General Manager*, J. H. Cowell; *Elec. Eng.*, P. P. Wheelwright; *Traffic Manager*, R. Riley; *Car Shed Supt*, H. W. Seymour; *Chairman Try. Com.*, Coun. C. Higham; *Vice-Chairman*, Ald. W. Thompson.

Blackpool Corporation Tramways, West Caroline Street, Blackpool. [T.N., 67.] *Gen. Manager*, C. Furness; *Traffic Supt.*, C. I. Baker; *Resident Eng.*, F. Field; *Chairman Try. Com.*, Coun. H. Brooks; *Vice-Chairman*, Coun. T. G. Lumb.

Bolton Corporation Tramways, Bradshawgate, Bolton. [T.A., Manager, Tramways, Bolton; T.N., 490.] *General Manager*, J. Barnard; *Elec. Eng.*, W. J. H. Wood; *Per. Way Eng.*, E. Ll. Morgan; *Rolling Stock Supt.*, C. Beech; *Chairman Try. Com.*, Coun. J. R. Horrocks; *Vice-Chairman*, Coun. P. Higson.

Bootle Corporation Tramways, Electricity Works, Pine Grove, Bootle. [T.N., 424.] *Elec. Eng.*, T. D. Clothier; *Chairman Try. Com.*, Ald. Booth; *Vice-Chairman*, Coun. Ashton.
[Lines worked by Liverpool Corporation Tramways.]

Bournemouth Corporation Tramways, Tramways Offices, Lansdowne Crescent, Bournemouth [T.A., Tramways, Bournemouth; T.N., 1701.] *General Manager*, I. Bulfin; *Chief Assistant & Elec. Eng.*, H. Vickers; *Traffic Supt.*, G. F. Glass; *Chairman Try. Com.*, Coun. J. Wilson; *Vice-Chairman*, Coun. W. H. Ridout.

Bradford Corporation Tramways, Central Office, 7, Hall Ings, Bradford. [T.A., Tramways, Bradford; T.N., 2381 and 2382.] *Gen. Manager*, R. H. Wilkinson; *Asst. Elec. Eng.*, Johnstone Wright; *Traffic Supt.*, T. Stirk; *City Elec. Eng.*, T. Roles; *Chairman Try. Com.*, Ald. Enoch Priestley; *Vice-Chairman*, Coun. I. F. Akeroyd.

Brighton Corporation Tramways, Lewes Road, Brighton. [T.A., Tramways, Brighton: T.N., 353 P.O.] *Eng. & Manager*, William Marsh; *Traffic Supt.*, W. N. Brooks; *Rolling Stock Supt.*, W. Orchard; *Per. Way Eng.*, F. N. Hudson; *Chairman Try. Com.*, Ald. J. Lintott.

Burnley Corporation Tramways, Queen's Gate, Burnley. [T.N., 46.] *Gen. Manager*, Henry Mozley; *Boro. Elec. Eng.*, J. E. Starkie; *Boro. Surveyor*, G. H. Pickles; *Chairman Try. Com.*, Coun. E. Heap; *Vice-Chairman*, Coun. D. D. Irving.

Burton-on-Trent Corporation Tramways, Guild Street, Burton-on-Trent. [T.N., 202.] *Manager*, A. B. Slater; *Engineer*, T. Hall; *Chairman Try. Com.*, Ald. J. S. Rowland; *Vice-Chairman*, Ald. T. E. Lowe.

Bury Corporation Tramways, Market Place, Bury. [T.N., 26.] *Gen. Manager*, Frank Buckley; *Boro. Elec. Eng.*, S. J. Watson; *Chairman Try. Com.*, Ald. T. S. Collinge, J.P.; *Vice-Chairman*, Coun. H. Hargreaves.

Cardiff Corporation Tramways, Central Offices, The Hayes, Cardiff. T.N., 1211, 1240, 1350, and 377.] *Gen. Manager*, R. L. Horsfield; *Elec. Eng.*, C. G. M. New; *Traffic Manager*, H. David; *Rolling Stock Supt.*, Jas. Preston; permanent way under supervision of *City Engineer*, E. J. Elford; *Chairman Try. Com.*, Ald. Sir J. W. Courtis, J.P.; *Vice-Chairman*, Ald. R. J. Smith.

Chester Corporation Tramways, Station Road, Chester. [T.N., 166.] *Manager*, W. H. Ellis; *Elec. Eng.*, S. E. Britton; *Per. Way Eng.*, W. M. Jones; *Chairman Try. Com.*, Ald. J. Jones; *Vice-Chairman*, Coun. A. S. Dutton.

Chesterfield Corporation Tramways, Chatsworth Road, Chesterfield. [T.A., Tramways, Chesterfield; T.N., 78.] *Gen. Manager*, R. H. Campion; *Assist. Gen. Manager*, W. A. Toppin; *Chairman Try. Com.*, Coun. P. M. Robinson; *Vice-Chairman*, Ald. Sir E. Shentall.

Colchester Corporation Tramways, Magdalen Street, Colchester. [T.A., Tramways, Colchester; T.N., 92.] *Gen. Manager and Engineer*, R. C. Bullough; *Chairman Try. Com.*, Coun. G. F. Wright; *Vice-Chairman*, Coun. W. Chopping.

Colne Corporation Tramways, Colne, Lancashire. *General Manager and Engineer*, J. Thompson *Chairman Try. Com.*, Coun. J. Thompson.

Coventry Corporation Tramways, Priestley's Bridge, Coventry. [T.A., Tramways, Coventry; T.N., 1014.] *Engineer and General Manager*, T. R. Whitehead; *Assistant Engineer*, W. M. Milnes; *Chairman*, Coun. French; *Vice-Chairman*, Coun. Bates.

Croydon Corporation Tramways, Tramways Office, Thornton Heath, Surrey. [T.A., Tramways, Croydon; T.N., 406, Croydon.] *Tramways Manager*, T. B. Goodyer; *Chairman Try. Com.*, Coun. A. A. Thomson; *Vice-Chairman*, Ald. G. J. Allen, J.P.

Darlington Corporation Tramways, Haughton Road, Darlington. [T.A., Tramways, Darlington; T.N., 2485.] *General Manager and Elec. Eng.*, J. R. P. Lunn; *Traffic Supt.*, J. Fraser; *Chairman Try. Com.*, Ald. Sir C. Starmer.

Dartford Urban District Council Light Railways, Dartford. *Chairman Try. Com.*, Coun. R. Penney; *Vice-Chairman*, Coun. W. J. Bourne.
[Lines worked by Bexley U.D. Council, *q.v.*]

Darwen Corporation Tramways. Lorne Street, Darwen. [T.N., 104.] *Gen. Manager and Eng.*, G. A. Newsome; *Boro. Elec. Eng.*, F. M. Fletcher; *Chairman Try. Com.*, Coun. Geo. Pickup; *Vice-Chairman*, Coun. G. Butterworth.

Derby Corporation Tramways, 4, Victoria Street, Derby. [T.N., 410.] *Gen. Manager*, F. Harding; *Elec. Eng.*, T. P. Wilmshurst; *Per. Way Eng.*, J. Ward; *Chairman Try. Com.*, Coun. W. Eaton, J.P.

Doncaster Corporation Tramways, Grey Friar's Road, Doncaster. [T.A., Rayner, Doncaster, T.N., 43.] *Manager*, T. Potts; *Elec. Eng.*, S. R. Windle; *Chairman Try. Com.*, Ald. S. Balmforth.

Dover Corporation Tramways, Town Hall, Dover. [T.A., Trams, Dover; T.N., 294.] *Gen. Manager*, E. H. Bond; *Per. Way Eng.*, W. C. Hawke (Boro. Surveyor); *Chairman Try. Com.*, Coun. Barwick; *Vice-Chairman*, Coun. Thomas.

Dundee Corporation Tramways, Town House Buildings, Dundee. [T.N., 1340]; *Gen. Manager and Eng.*, W. P. Young; *Elec. Eng.*, H. Richardson; *City Eng.*, J. Thomson; *Chairman Try. Com.*, Coun. A. Malcolm.

East Ham Corporation Tramways, Nelson Street, East Ham. [T.N., 311 and 100 East Ham.] *Gen. Manager and Elec. Eng.*, W. C. Ullmann; *Chairman Try. Com.*, Ald. Oakes, J.P.; *Vice-Chairman*, Coun. Newling.

Eccles Corporation Tramways, Eccles. *Elec. Eng.*, H. W. Angus; *Per. Way Eng.*, T. S. Picton; *Chairman Try. Com.*, Coun. Alexander; *Vice-Chairman*, Ald. Pearson. [Lines worked by Salford Corporation.]

Edinburgh Corporation Tramways, 2, St. James' Square, Edinburgh. *Gen. Manager*, R. S. Pilcher; *Traffic Supt.*, R. McLeod; *Burgh Engineer*, A. H. Campbell; *Chairman Try. Com.*, Coun. W. R. Sleigh.
[The entire system of the Edinburgh tramways is at present worked by cable traction, with the exception of 1¼ miles of electric lines. The Council has decided to electrify the whole of the system, and plans are now being made for the commencement of the work.]

Erith Urban District Council Tramways, Tramway Depôt, Walnut Tree Road, Erith. [T.A., Tramways, Erith; T.N., 36.] *Gen. Manager and Elec. Engineer*, J. C. Williams; *Chairman Try. Com.*, Coun. W. F. B. Howell.

Exeter Corporation Tramways, Heavitree Road, Exeter. *Gen. Manager*, R. O. Baldwin; *Elec. Eng.* H. D. Munro; *Per. Way Eng.*, T. Moulding; *Chairman Try. Com.*, Coun. F. G. Towill; *Vice-Chairman*, Coun. F. Chick.

Farnworth Urban District Council Tramways, Albert Road, Farnworth. *Chairman Try. Com.*, Coun. Barnes; *Vice-Chairman*, Coun. R. H. Cunliffe, J.P.
[Lines leased to the South Lancashire Trys. Co.]

Glasgow Corporation Tramways, 46, Bath Street, Glasgow. [T.A., Trams, Glasgow; T.N., 1040, Douglas.] *Gen. Manager*, J. Dalrymple; *Deputy Gen. Manager*, L. Mackinnon; *Chief Eng.*, J. Ferguson; *Elec. Eng.*, ———— *Sec. and Treasurer*, J. N. Wilson; *Chairman Try. Com.*, Bailie M'Whirr; *Vice-Chairman*, Bailie Laing.

Gloucester Corporation Light Railway, Bristol Road Depôt, Gloucester. [T.A., Tramways, Gloucester; T.N. 155.] *Gen. Manager and Elec. Eng.*, F. H. Corson; *Chairman Try. Com.*, Coun. J. O. Roberts (Mayor); *Vice-Chairman*, Coun. W. Colwell.

Great Yarmouth Corporation Tramways, Caister Road, Great Yarmouth. [T.N. 265.] *Gen. Manager*, F. L. Turner; *Elec. Eng.*, Gordon Bryant; *Per. Way. Eng.*, J. W. Cockrill (Borough Surveyor); *Chairman Try. Com.*, Ald. D. McCowan.

Halifax Corporation Tramways, Skircoat Road, Halifax. [T.N., 36 and 382.] *Traffic Manager*, Jas. D. Caird; *Try. Eng.*, J. W. Galloway; *Per. Way Eng.*, J. Lord (Boro. Eng.); *Chairman Try. Com.*, Ald. C. F. Spencer; *Vice-Chairman*, Ald. A Broadley.

Haslingden Corporation Tramways, John Street, Haslingden. *Gen. Manager, Elec. Eng., and Per. Way Eng.*, Barnes Kay; *Chairman Try. Com.*, Coun. Haworth; *Vice-Chairman*, Ald. Russell.

Herne Bay Pier Tramway (owned and worked by Herne Bay U.D.C.), Herne Bay. [T.N., 22.] *Res. Manager*, P. W. Carey.

Heywood Corporation Tramways, Heywood, Lancs. [T.N., 47.] *Gen. Manager*, D. H. Davies; *Per. Way Eng.*, J. B. Nuttall; *Chairman Try. Com.*, Ald. J. Ashworth, J.P.; *Vice-Chairman*, Ald. T. Popple, J.P.

Huddersfield Corporation Tramways, John William Street, Huddersfield. [T.N., 698 and 898.] *Gen. Manager and Eng.*, A. A. Blackburn; *Track Eng.*, K. F. Campbell (Borough Eng.); *Elec. Eng.*, J. W. Turner; *Traffic Supt.*, T. Hartley; *Chairman Try. Com.*, Coun. E. H. Sellers; *Vice-Chairman*, Coun. T. Canby.

Hull Corporation Tramways, Alfred Gelder Street, Hull. [T.N., 444, Corporation] *Manager*, E. S. Rayner; *Traffic Supt.*, C. F. Ellwood; *Engineer*, F. W. Bricknell (City Engineer) [T.N., 943, Corporation]; *Chairman Try. Com.*, Coun. A. D. Willoughby; *Vice-Chairman*, Coun. C. P. Sherwood.

Ilford Urban District Council Tramways, Ley Street, Ilford. [T.N., 684.] *Manager and Engineer*, L. E. Harvey; *Chairman Try. Com.*, Coun. G. R. Davey; *Vice-Chairman*, Coun. H. L. Crofts.

Ipswich Corporation Tramways, Constantine Road, Ipswich. [T.A., Ayton, Tramways, Ipswich; T.N., 354.] *Gen. Manager and Elec. Eng.*, Frank Ayton; *Traffic Supt.*, A. Butler; *Rolling Stock Supt.*, W. A. Fairhead; *Chairman Try. Com.*, Coun. E. C. Ransome (Mayor) *Vice-Chairman*, Coun. W. P. Burton.

Kearsley Urban District Council Tramways, Council Office, Kearsley, Farnworth, S.O. *Clerk U. D. C.*, H. Martin.
[Lines leased to and worked by the South Lancashire Tramways Co.]

Keighley Corporation Tramways, Coney Lane, Keighley. [T.A., Tramways, Keighley; T.N., 13 & 263.], *Gen. Manager*, J. A. Bromley; *Elec. Eng.*, H. Webber *Chairman Try. Com.*, Coun. J. Crabtree.

Kilmarnock Corporation Tramways Electricity Works, Kilmarnock. [T.N., 95.] *Elec. Eng. and Manager*, J. H. Menzies. *Consulting Engineers*, Kennedy and Jenkin; *Convener Try. Com* Coun. Dunlop.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM

Kirkcaldy Corporation Tramways, Electricity Works Victoria Road, Kirkcaldy. [T.A., Tramways, Kirkcaldy. T.N., 124, 174, and 175.] *Manager & Elec. Eng.*, O. F. Francis; *Traffic Manager*, Jas. Fisher; *Chairman Try. Com.*, Coun. G. Fergusson.

Lancaster Corporation Tramways, Electricity Works, Lancaster. [T.A., Milnes, Tramways, Lancaster; T.N., 1, L.] *Gen. Manager & Elec. Eng.*, G. C. Milnes; *Acting Boro. Electrical Engineer and Tramways Manager*, J. B. Patterson; *Traffic Manager*, W. T. Charlton; *Chairman Try. Com.*, Coun. T. Wilkinson, (Mayor).

Leeds City Tramways, Swinegate, Leeds. [T.A., Tramways, Leeds; T.N., 21601; *General Manager*, J. B. Hamilton; *Traffic Supt.*, A. Daggett; *Elec. Eng.*, John Burbridge; *Highways and Per. Way Eng.*, E. W. Cockerlyne; *Car Works Supt.*, G. E. Watmough; *Chairman Try. Com.*, Ald. R. A. Smithson; *Vice-Chairman*, Ald. H. Brown.

Leicester Corporation Tramways, 20 and 22, Humberstone Gate, Leicester. [T.N., 2177.] *Manager & Sec.*, A. F. Lucas; *Boro. & Try. Eng.*, E. G. Mawbey; *Boro. Elec. Eng.*, T. R. Smith; *Cons. Engs.*, Kincaid, Waller & Manville; *Chairman Try. Com.*, Ald. S. Flint, J.P.; *Vice-Chairman*, Ald. G. Banton, J.P.

Leith Corporation Tramways, 165, Leith Walk, Leith. [T.N., 415.] *Gen. Manager*, F. A. Fitzpayne; *Per. Way Eng.*, J. R. Findlay (*Burgh Eng.*); *Chairman Try. Com.*, Bailie Goalen.

Leyton District Council Tramways, Car Depot, Lea Bridge Road, Leyton, E. [T.A., Tramways, Leyton; T.N., 17 Walthamstow.] *Manager*, F. Schofield; *Elec. Eng.*, F. Harman Lewis; *Per. Way Eng.*, E. H. Essex; *Chairman Try. Com.*, Coun. C. W. Daines.

Lincoln Corporation Tramways, Brayford Side North, Lincoln. [T.A., Clegg 109 Lincoln; T.N., 109]. *General Manager and Elec. Eng.*, Stanley Clegg; *Chairman Try. Com.*, Ald. W. S. White.

Liverpool Corporation Tramways, 24, Hatton Garden, Liverpool. [T.A., Tramways, Liverpool; T.N., 6054 and 7701, Central.] *General Manager*, P. Priestly; *Per. Way Eng.*, J. A. Brodie (*City Engineer*); *Rolling Stock Supt.*, T. Ridyard; *Chairman Try. Com.*, Coun F. C. Wilson; *Vice-Chairman*, Ald. F. Smith, J.P.

London County Council Tramways, 23, Belvedere Road, Lambeth, London, S.E.1. [T.A., Lotram, Watloo, London; T.N., 4335 Hop] *General Manager*, A. L. C. Fell; *Traffic Manager*, J. K. Bruce; *Electrical Engineer*, P. L. Riviere; *Rolling Stock Eng.*, W. E. Ireland; *Per. Way Eng.*, J. Welling; *Chairman Highways Com.*, W. J. Squires; *Vice-Chairman*, Lieut.-Comm. A. Cooper Rawson.

Lowestoft Corporation Tramways, Norwich Road, Lowestoft. [T.N., 87.] *Gen. Manager*, H. H. Saunders; *Elec. Eng.*, W. R. May; *Chairman Try. Com.*, Coun. F. Spashett.

Maidstone Corporation Tramways, Tramway Offices, Tonbridge Road, Maidstone. [T.A., Lambert, Tramways, Maidstone; T.N., 448] *Gen. Manager and Elec. Eng.*, A. T. Lambert; *Chairman Try. Com.*, Ald. D. T. J. Lyle; *Vice-Chairman*, Coun. Armstrong.

Manchester Corporation Tramways, 55, Piccadilly, Manchester. [T.A., Tramways, Manchester; T.N., 7800 City.] *Gen. Manager*, J. M. McElroy; *Traffic Sup.*, J. T. Oakes; *Elec. Eng.*, J. J. McMahon; *Chief Civil Eng.*, H. Mattinson; *Rolling Stock Supt.*, G. R. Blackburn; *Chairman Try. Com.*, Ald. J. Bowes; *Vice-Chairman*, Ald. A. W. Chapman.

Middlesbrough Corporation Tramways Middlesbrough. *Gen. Manager*, H. G. Jeken; *Chairman, Try. Com.*, Coun. E. Turner; *Vice-Chairman*, Ald. J. Calvert.

Middlesex County Council Light Railways, Middlesex Guildhall, Westminster, London, S.W. *County Eng.*, H. T. Wakelam, M.I.C.E.: *Chairman of Light Railways Com.*, County Ald. H. Burt; *Vice-Chairman*, County Ald. F. Goodyear.

Nelson Corporation Light Railways, Charles Street, Nelson. [T.N., 115.] *Manager and Elec. Eng.*, G. F. Nayler; *Per. Way Eng.*, W. Shackleton; *Chairman Try. Com.*, Ald. W. F. Cooke.

Newcastle-upon-Tyne Corporation Tramways, Manors, Newcastle. [T.A., Traction, Newcastle; T.N., 913 and 914 Central.] *Gen. Manager & Engineer*, Ernest Hatton; *Traffic Supt.*, T. Chalder; *Per. Way Eng.*, W. J. Steele; *Chairman Try. Com.*, Ald. R. Mayne; *Vice-Chairman*, Coun. Sir A. M. Sutherland.

Newport (Mon.) Corporation Tramways, Town Hall, Newport, Mon. [T.A., Dynamo, Newport, Mon.; T.N., 3111 and 2932, Nat.] *Gen. Manager*, N. J. Young; *Boro. Elec. and Tramways Eng.*, A. Nichols Moore; *Chairman Try. Com.*, Coun. J. Moxon; *Vice-Chairman*, Ald. F. Phillips.

Northampton Corporation Tramways. St. James', Northampton. [T.N., 279 & 280.] *Gen. Manager and Elec. Eng.*, J. F. Cameron; *Chairman Try. Com.*, Ald. James *Vice-Chairman*, Coun. Wareing.

Nottingham Corporation Tramways, Beastmarket Hill, Nottingham. [Tramways, Nottingham; T.N., 225.] *General Manager & Elec. Eng.*, John Aldworth; *Traffic Supt.*, H. Morley; *Per. Way Eng.*, Arthur Brown (*City Eng.*); *Rolling Stock Supt.*, W. Boot; *Chairman Try. Com.*, Coun. Clarkson; *Vice-Chairman*, Ald. Turney.

Oldham Corporation Tramways, Wallshaw Depot, Oldham. [T.A., Tramways, Oldham; T.N., 1195.] *Gen. Manager & Eng.*, Wm. Chamberlain; *Traffic Supt.*, M. Mullin; *Chairman Try. Com.*, Coun. J. K. Cheetham; *Vice-Chairman*, Ald. W. Stanbury.

Perth Corporation Tramways, 128, High Street, Perth. [T.N., 226 & 101.] *Tramways Manager*, W. G. Snell; *Elec. & Tramways Eng.*, John Lambert; *Per. Way Eng.*, R. McKillop (*Burgh Surv.*); *Chairman Try. Com.*, Coun. A. W. Fisher.

Plymouth Corporation Tramways, Drake Circus, Plymouth. [T.N. 518, Plymouth.] *Gen. Manager*, H. P. Stokes; *Elec. Eng.*, E. J. Okell; *Chairman Try. Com.*, Ald. Sir Thos. Baker; *Vice. Chairman*, Coun. J. Moon.

Pontypridd Urban District Tramways, Generating Station, Treforest, Pontypridd. [T.N. 33.] *Gen. Manager and Elec. Eng.*, J. E. Teasdel; *Traffic Supt.*, A. Armstrong; *Per. Way Eng.*, W. E. Lowe (*Surveyor*); *Chairman Try. Com.*, Coun. M. L. Jones.

Portsmouth Corporation Tramways, Town Hall, Portsmouth. [T.N., 4910 Corporation.] *Gen. Manager*, W. R. Spaven; *Elec. Eng., and Rolling Stock Supt.*, V. G. Lironi; *Traffic Supt.*, W. Munford; *Chairman Try. Com.*, Coun. J. Timpson, J.P. (Mayor); *Vice-Chairman*, Coun. W. Cleave.

Preston Corporation Tramways, Holmrook Road, Preston. [T.A., Corporation Tramways, Preston; T.N., 273.] *Gen. Manager and Elec. Eng.*, J. F. Simpson; *Assistant Manager and Engineer*, H. Clayton; *Chairman, Try. Com.*, Ald. T. Parkinson; *Vice-Chairman*, Ald. J. Ormrod.

Radcliffe Urban District Council Tramways, Council Offices, Radcliffe, Lancs. *Res. Eng.*, H. Wilkinson; *Per. Way Eng.*, W. L. Rothwell; *Clerk*, S. Mills; *Chairman Try. Com.*, Coun. Lund.

[These tramways are worked as part of the Bury system.]

Rawtenstall Corporation Tramways, Bacup Road, Rawtenstall. [T.N., 81.] *Gen. Manager and Elec. Eng.*, C. L. E. Stewart; *Chairman Try. Com.*, Coun. H. Crabtree; *Vice-Chairman*, Coun. J. W. Stansfield.

Reading Corporation Tramways, Mill Lane, Reading. [T.A., Tramways Manager, Reading; T.N., 330.] *Gen. Manager & Elec. Eng.* J. M. Calder; *Chairman Try. Com.*, Ald. C. G. Field, J.P.

Rochdale Corporation Tramways, Mellor Street, Rochdale. [T.A., Tramways, Rochdale; T.N., 48.] *Gen. Manager & Eng.*, G. Webster; *Traffic Manager*, R. Bentley; *Per. Way Eng.*, H. Yarwood; *Rolling Stock Supt.*, E. Sidgwick; *Chairman Try. Com.*, Ald. J. Taylor.

Rotherham Corporation Tramways, St. George's Hall, Rotherham. [T.A., Tramways, Rotherham; T.N., 152 and 241.] *General Manager*, T. P. Sykes; *Per. Way Eng.*, T. P. Collinge; *Traffic Supt.*, W. G. Marks; *Rolling Stock Supt.*, H. B. Sharp; *Chairman Try. Com.*, Ald. G. Gummer, J.P.; *Vice-Chairman*, Coun. G. E. Caine, J.P.

St. Annes-on-the-Sea Council Tramways, Squires Gate, South Shore, Blackpool. [T.N., 327.] *Gen. Manager*, H. W. Laing; *Traffic Manager*, G. W. Wood; *Chairman Try. Com.*, Coun. A. E. H. Lee.

St. Helens Corporation Tramways, Hall Street, St. Helens, Lancs. *Gen. Manager*, L. C. F. Bellamy; *Chairman Try. Com.*, Coun. A. Rudd, J.P.; *Vice-Chairman*, Coun. T. Abbott, J.P.

Salford Corporation Tramways, 32, Blackfriars Street, Salford. [T.A., Tramways, Salford; T.N., 5367 and 5368 Central.] *Gen. Manager*, Geo. W. Holford; *Elec. Eng.*, J. A. Robertson; *Traffic Supt.*, J. W. Blakemore; *Per. Way Supt.*, E. B. Martin; *Rolling Stock Supt.*, R. Chadwick; *Chairman Try. Com.*, Ald. H. Linsley, J.P.; *Vice-Chairman*, Ald. W. H. Barrett.

Sheffield Corporation Tramways, 8, Division Street, Sheffield. [T.A., Tramways, Sheffield; T.N., 4600.] *General Manager*, A. R. Fearnley; *Assist. Man.*, H. Watson; *Per. Way Eng.*, W. J. Hadfield; *Rolling Stock Supt.*, J. Smith; *Chairman Try. and Motors Com.*, Ald. Sir W. E. Clegg, J.P.; *Vice-Chairman*, Ald. W. C. Fenton, J.P.

Shipley Urban District Tramway, Dockfield, Shipley. [T.A., Electricity Works, Shipley; T.N., 190.] *Elec. Eng.*, Wm Redman; *Chairman Try. Com.*, Coun. F. F. Rhodes; *Vice-Chairman*, Coun. H. Bradley.

[Lines leased to Bradford Corporation.]

Southampton Corporation Tramways, 161, Above Bar, Southampton. [T.A., Tramways, Southampton; T.N., 801.] *Gen. Manager*, J. Dobson; *Boro. Elec. Eng.*, W. G. Turner; *Traffic Manager*, J. Brierley; *Chairman Try. Com.*, Ald. F. A. Dunsford, J.P.

Southend-on-Sea Corporation Tramways, London Road, Southend-on-Sea. [T.N., 96.] *Gen. Manager and Elec. Eng.*, R. Birkett; *Traffic Manager*, J. T. Fayle; *Per. Way Eng.*, R. H. Dyer (*Acting Boro. Surveyor*); *Rolling Stock Supt.*, J. Dobson; *Chairman Try. Com.*, Coun. C. Radford.

Southend Pier Electric Railway, (owned and worked by Southend-on-Sea Corporation), [T.A., Piermaster, Southend; T.N., 91.] Southend-on-Sea. *Elec. Eng.*, C. R. Norton; *Acting Piermaster*, J. C. Herbert; *Chairman*, Coun. F. Britain.

Southport Corporation Tramway, 44, Chapel Street, Southport. [T.N., 116.] *Gen. Manager*, T. J. Kendrew; *Boro' Elec. Eng.*, A. S. Black; *Chairman Try. Com.*, Ald. Richardson; *Vice-Chairman*, Coun. Lloyd.

South Shields Corporation Tramways, Dean Road, South Shields. [T.A., Tramways, South Shields; T.N., 157.] *Gen. Manager & Elec. Eng.*, J. C. Whiteley; *Boro. Elec. Eng.*, Edgar Maxon; *Chairman Try. Com.*, Ald. W. G. Wylie; *Vice-Chairman*, Ald. J. G. Winskell.

Stalybridge Hyde, Mossley, and Dukinfield Tramways and Electricity Board, Waterloo Road, Stalybridge. [T.N., 311.] *Commercial Manager*, F. Schofield; *Chief Eng.*, R. Blackmore; *Chairman Try. Com.*, Ald. H. Sykes; *Vice-Chairman*, Coun. W. H. Rhodes.

Stockport Corporation Tramways, Mersey Square, Stockport. [T.N., 232 and 237.] *Manager*, A. T. Eardley; *Elec. Eng.*, R. Lomax; *Chairman Try. Com.*, Coun. T. W. Potts, O.B.E.; *Vice-Chairman*, Coun. W. Merrison.

Sunderland Corporation Tramways, Tramway Offices, Monkwearmouth, Sunderland. [T.A., Trys. Manager, Sunderland; T.N., 948.] *Gen. Manager and Elec. Eng.*, A. R. Dayson; *Per. Way Eng.*, T. Inglis Rudman; *Chairman Try. Com.*, Ald. G. New, J.P.; *Vice-Chairman*, Ald. W. Walker, J.P.

Swindon Corporation Tramways, Electricity Works, Swindon. [T.A., Tramways, Swindon; T.N., 4.] *General Manager*, T. Medcalf; *Elec. and Mech. Eng.*, F. Newey; *Chairman Try. Com.*, Ald. G. H. Stevens; *Vice-Chairman*, Coun. Noble.

Tees-side Railless Traction Board, Middlesbrough Road, South Bank, Yorkshire. [T.A. Railless Board, South Bank; T.N., 31, South Bank]. *General Manager and Engineer*, J. B. Parker; *Chairman* Councillor W. G. Grace.

Wallasey Corporation Tramways, Seaview Road, Wallasey. [T.A., Tramways, Liscard; T.N., 1481, Liscard.] *General Manager*, R. R. Greene; *Elec. Eng.*, J. H Crowther; *Per. Way Eng.*, W. H. Travers; *Chairman Try. Com.*, Coun. F. E. Howse; *Vice-Chairman*, Coun. H. W. Griffin.

Walsall Corporation Tramway, St. Paul's Buildings, The Bridge, Walsall. [T.A., Tramways, Walsall; T.N., 238 & 559.] *Gen. Manager*, Chas. Burgess; *Elec. Eng.*, H. A. Howie; *Per. Way Eng.*, J. Taylor (*Boro. Surveyor*); *Chairman, Try. Com.*, Ald. J. Cope *Vice-Chairman*, Ald. J. Williams.

Walthamstow Urban District Council Tramways, Chingford Road, Walthamstow, [T.A., Tramways, Walthamstow; T.N., 20.] *Tramways Manager*, W. Murray; *Elec. Eng.*, G. R. Spurr (Priory Avenue, Walthamstow); *Per. Way Eng.*, G. W. Holmes; *Chairman Trys. Com.*, Coun. J. W. West.

Warrington Corporation Tramways, Mersey Street, Warrington. [T.N., 196] *Gen. Manager*, J. Telfer; *Elec. Eng.*, F. V. L. Mathias; *Chairman Try. Com.*, Ald. Sir. P. Peacock, J.P.; *Vice-Chairman*, Ald. J. Wilkinson.

West Bromwich Corporation Tramway, Electricity Works, West Bromwich. [T.N., 100.] *Boro. Eng.*, A. D. Greatorex; *Boro. Elec. Eng.*, W. A. Jackson; *Chairman Highways Com.*, Ald. A. G. Turley, J.P.; *Vice-Chairman*, Coun. Wheatley.

[These tramways are leased to the South Staffs. (Lessee) Co., Ltd.]

West Ham Corporation Tramways, Greengate Street, Plaistow, London, E. [T.A., Trameurs, Plais., London; T.N., 862 and 868 East.] *General Manager*, L. Slattery; *Boro' Elec. Eng.*, F. W. Purse; *Chairman Try. Com.*, Coun. G. Croot.

West Hartlepool Corporation Tramways, Cleveland Road, West Hartlepool. [T.N., 6073.] *Gen. Manager and Eng.*, T. G. Richardson; *Chairman Try. Com.*, Ald. Martin; *Vice-Chairman*, Coun. Turnbull.

Wigan Corporation Tramways, Market Place, Wigan; [T.N., 226.] *General Manager and Eng.*, B. Hall; *Traffic Supt.*, R. Hoggard; *Per. Way Eng.*, R. B. Donald; *Chairman Try. Com.*, Coun. A. Guest; *Vice-Chairman*, Coun. J. Walkden.

Wolverhampton Corporation Tramways, Municipal Tramway Offices, Cleveland Road, Wolverhampton. [T.N., 324.] *Gen. Manager and Engineer*, C. O. Silvers; *Boro. Elec. Eng.*, S. T. Allen; *Per. Way Eng.*, George Green; *Chairman Try. Com.*, Ald. Sir S. Craddock.

Yarmouth Corporation Tramways (See Great Yarmouth Corporation Tramways).

York Corporation Tramways, 8, Clifford Street, York. [T.N., 302]. *Gen. Manager and Elec. Eng.*, J. W. Hame; *Traffic Supt.*, J. W. Horton; *Per. Way Eng.*, F. W. Spurr (City Surveyor); *Chairman Try. Com.*, Coun. W. H. Sessions; *Vice-Chairman*, Ald. C. W. Shipley.

COMPANY TRAMWAYS

Aberdeen Suburban Tramways Company, 15, Golden Square, Aberdeen. [T.A., Judicial, Aberdeen; T.N., 2583.] *Manager & Per. Way Eng.*, A. Wilkie; *Sec.*, G. Duncan; *Chairman*, James Mearns; *Directors*, Dr. W. Christie, Jas. Sellar.

Airdrie and Coatbridge Tramways Company, Tramway Depôt, Main Street, Coatbridge [T.N., 105], and Electrical Federation Offices, Kingsway, London, W.C. *Gen. Manager*, A. Robertson; *Sec.*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, H. S. Day, A. C. Miles, G. J. Somerville.

Barnsley and District Electric Traction Company, Ltd., Car Depot, Sheffield Road, Barnsley. [T.A., Tramways, Barnsley; T.N., 159.] *General Manager*, W. E. Nicoll; *Acting Sec.*, P. N. Gray; *Chairman*, E. Garcke; *Directors*, Col. Sir Thomas Pilkington, Bart., E. A. Paris.

Barrow-in-Furness Tramways, Salthouse Road Depot, Barrow.

[These Tramways have been purchased, and are now worked by Barrow-in-Furness Corporation.]

Bath Electric Tramways Company, Ltd., Walcot Street, Bath, and 119-125, Finsbury Pavement, London, E.C. [T.A., Trams, Bath; T.N., 1214.] *Gen. Manager and Eng.*, W. E. Hardy; *Traffic Supt.*, ——————; *Sec.*, H. J. Almond; *Chairman*, J. B. Hamilton; *Directors*, H. F. Clutterbuck, E. H. R Trenow, A. A. C. Swinton.

Bessbrook and Newry Tramway Company Bessbrook, Co. Armagh. [T.A., Tramways, Bessbrook.] *Manager*, M. Hamilton; *Eng.*, H. Dowell *Chairman*, J. N. Richardson; *Directors*, C. H. Richardson, R. T. Scott, T. W. Richardson, J. McGreggor Greer.

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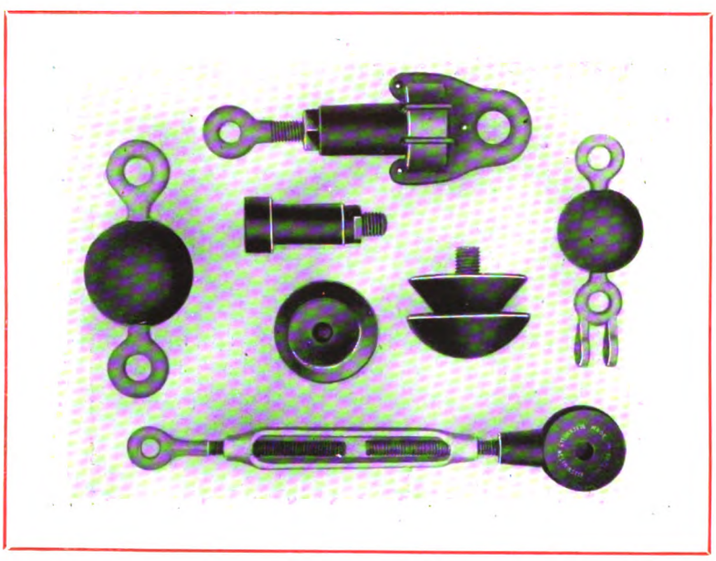

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM

Birmingham District Power and Traction Company, Power Station, Downing Street, Smethwick, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Power Station, Smethwick; T.N., 65 Smethwick.] *Gen. Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, C. Shirreff Hilton; *Directors*, J. A. Lycett, W. L. Madgen, S. R. Blundstone, R. J. Howley.

Blackpool and Fleetwood Tramroad. [This Tramway is now owned and worked by Blackpool Corporation.]

Blackpool and Fylde Light Railway Company, 5, Clifton Street, Blackpool. (No appointment of engineer or officials yet made.) *Secretary*, R. Bibby; *Chairman*, John Greenwood; *Directors*, T. Fisher, J.P., John Platt, J.P., W. Hardman, J.P., R. H. Mabbott.

Brighton Beach Electric Railway, Madeira Road, Brighton. [T.A., Volk, Brighton; T.N., 14 P.O.] *Manager and Eng.*, Magnus Volk; *Traffic Superintendent*, Miss Barton; *Per. Way Eng.*, J. Barker; *Secretary*, A. Volk; *Chairman*, Magnus Volk; *Directors*, M. H. Volk, B. W. Symonds, A. Volk.

Bristol Tramways and Carriage Company, Ltd., Clare Street House, Bristol. [T.A., Cab, Bristol; T.N., 74 & 3074 Nat.] *Manager*, Colonel S. E. Smith; *Assist. Manager*, W. H. Stradling; *Electrical Engineer*, W. Nairn; *Permanent Way Engineer*, G. T. C. Edwards; *Secretary*, H. F. Cooper; *Chairman*, S. White, J.P.; *Directors*, W. G. Verdon Smith (*Managing*), J. H. Howell, J.P., Sir G. Stanley White, Bart., S. E. Baker, Chas. Challenger.

British Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. J. S. Austen (*chairman*); *Directors*, E. Garcke, C. Shirreff Hilton, W. L. Madgen, Sir Charles Ollivant, A. Shepherd, C. G. Tegetmeier, P. D. Tuckett. *Manager*, C. H. Dade; *Secretary*, T. Bower; *Accountant*, C. Walmsley.

This company is interested in the following tramways, particulars of which are given under their respective names:

Airdrie & Coatbridge.
Barnsley & District.
Barrow-in-Furness.
Birmingham & District Power & Traction Co.:
Birmingham & Midland
Dudley, Stourbridge, & District.
South Staffordshire.
Wolverhampton Dist.
Devonport & District.
Gateshead & District.
General Elec. Tramways.
Gravesend & Northfleet.
Greenock & Port Glasgow.
Jarrow & District.
Kidderminster & District.
Merthyr.
Middleton.
Oldham, Ashton, & Hyde.
Peterborough.
Potteries.
Rothesay.
Sheerness & District.
Swansea.
Taunton.
Tynemouth & District.
Weston-super-Mare & District.
Worcester.
Wrexham & District.
Yorkshire (Woollen Dist.)

Burton and Ashby Light Railway, Power Station, Swadlincote, nr. Burton-on-Trent. [T.A., Toulmin, Swadlincote; T.N., 1.] *Manager and Eng.*, Jas. Toulmin; *Secretary*, W. N. Bancroft; *Chairman*, G. Murray Smith.

[The line is owned and worked by the Midland Railway Company.]

Camborne and Redruth Tramways, Elec. Works, Carn Brea, R.S.O., Cornwall. [T.N., 3, Camborne.] (Owned by Urban Elec. Supply Co.) *Manager and Eng.*, L. A. Harda; *Sec.*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, H. B. Grotian, Sir Douglas Owen.

Carlisle Tramways Company, Ltd., City of, Depot and Offices, London Road, Carlisle. [T.A., Tramways, Carlisle; T.N., 0180.] *Engineer and Manager*, E. W. Sleight.

Chatham and District Light Railways Company, Luton Road, Chatham, and 83, Cannon Street, London, E.C. [T.A., Tramways, Chatham; T.N., 51.] *General Manager*, W. Jensen; *Assist. Manager*, A. J. Bousfield; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, H. C. Levis, J. F. Nauheim, W. B. H. Martindale.

Cheltenham and District Light Railway Company, Cheltenham. [T.N., 341.] *Chairman*, A. R. Holland; *Directors*, A. H. Beatty, W. Shearer, H. L. Williams, A. S. Guinness, H. J. McCormick; *Sec.*, Wm. C. Bryden, C.A., 66, Queen Street, London, E.C.; *Local Eng. and Manager*, Henry J. McCormick, Dalkeith, Gloucester Road, Cheltenham.

Clontarf and Hill of Howth Tramroad Company, 39, Dame Street, Dublin. [T.A., c/o Railways, Dublin; T.N., 917.] *Secretary*, J. P. Chapman; *Chairman*, W. L. Murphy; *Directors*, E. Anderson, J. J. Dudley.

Cork Electric Tramways and Lighting Company, Ltd., Albert Street, Cork. [T.A., Tramways, Cork; T.N., 78 and 635.] *Manager and Engineer*, H. H. Nalder; *Traffic Manager*, H. G. Whiting; *Per. Way Engineer*, H. Mack; *Secretary*, A. Clements; *Chairman*, A. R. Monks; *Directors*, E. Anderson, Capt. W. Martindale, H. C. Levis.

Dartford Urban District Council Light Railways. Car Depot, Priory Road, Dartford. [T.N., 31 Dartford.] (Leased to and worked by Bexley Urban District Council, Broadway, Bexleyheath, Kent).

Devonport and District Tramways Company, Electrical Federation Offices, Kingsway, London, W.C. *Secretary*, S. M. Wright; *Acting Sec.*, P. N. Gray; *Chairman*, C. S. B. Hilton; *Directors*, J. S. Raworth, E. R. Soames, C. G. Tegetmeier, R. J. Sutcliffe.

[This Company's undertaking has been sold to Plymouth Corporation.]

Dewsbury, Batley, and Birstall Tramways Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C.

[Lines worked by Yorkshire (Woollen District) Electric Tramways, Ltd., *q.v.*]

Dewsbury and Ossett Corporation and Soothill Nether Urban District Council Tramways, (Lessees: The National Elec. Construction Co., Ltd., 62 and 63, Queen Street, London, E.C.) [T.A., Overhauled, London; T.N., 6616 and 6617 City.] *Manager*, W. McGibbon.

Douglas—Ramsey. (The Manx Elec. Rly. Company), 1, Strathallan Crescent, Douglas. (See Manx Electric Railway Company).

Douglas Southern Electric Tramways, Ltd., Marine Drive, Douglas, Isle of Man, and 24, Brazennose Street, Manchester. [T.A., Traffic, Douglas.] *Manager and Eng.*, R. Orton; *Sec.*, J. E. Sharples; *Chairman*, T. J. Hutchinson; *Directors*, I. E. Winslow, E. A. Hopkins.

Dublin and Lucan Electric Railway Company, 16, Conyngham Road, Dublin. [T.A., Lucan Tramway, Dublin; T.N. 2282, 4005 and 4006 Dublin, and 5 Lucan.] *Manager, Elec. Eng., and Sec.*, D. McDowall Grosart, J.P.; *Chairman*, J. W. Hill, J.P.; *Directors*, E. Anderson, J.P., A. B. Coyle, J.P., G. V. Murphy, J. R. Dillon.

Dublin United Tramways Company (1896), Ltd., 9, Upper Sackville Street, Dublin. [T.A., Tramways, Dublin; T.N., 58 and 59.] *Gen. Manager*, G. Marshall Harriss; *Elec. Eng.*, R. Tanham; *Con. Eng.*, H. F. Parshall; *Per. Way Eng.*, P. F. O'Sullivan; *Secretary*, W. McHugh; *Chairman*, Rt. Hon. L. A. Waldron, P.C.; *Directors*, Joseph Mooney, J.P., William Hewat, Capt. Wm. L. Murphy.

Dudley, Stourbridge and District Electric Traction Company, Ltd. (Section of The Birmingham and Midland Tramways Joint Committee), Power Station, Downing Street, Smethwick, Brierley Hill, Staffs., and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 65 Smethwick.] *General Manager*, W. G. Bond; *Secretary*, E. H. Woodhall; *Chairman*, S. R. Blundstone; *Directors*, J. A. Lycett, R. J. Howley, B. Kingsford (*Acting Sec.*)

Dumbarton Burgh and County Tramways Company, Tramway Depot, Dumbarton, and 23, Rutland Street, Edinburgh. [T.A., Tramways, Dumbarton; T.N., 119.] *Gen. Manager and Elec. Eng.*, J. P. McMahon; *Secretary*, A. Dishart; *Chairman*, G. Balfour; *Directors*, K. Sanderson, K. A. Scott Moncrieff.

Dundee, Broughty Ferry & District Tramways Company, Milton, Monifieth, N.B. [T.N., 24 Monifieth.] *Gen. Manager and Engineer*, George Brander; *Secretary*, E. Cowan; *Chairman*, George Balfour; *Directors*, Edward Cowan, David Hynd.

Dunfermline and District Tramways Company, Tramway Depot, Cowdenbeath, Fife, and 8, New Row, Dunfermline. *Manager and Engineer*, J. H. Shepherd; *Secretary*, G. A. Nicolson; *Cons. Engs.*, Hawtayne & Zeden; *Directors*, Wm. Low, G. Balfour (*managing*), K. Sanderson, D. Hynd.

Falkirk & District Tramways Company, Larbert Road, Larbert, Stirlingshire. [T.A., Tramways Co., Falkirk; T.N., 154 Falkirk.] *Gen. Manager and Engineer*, D. Hays; *Chairman*, G. M. Brown; *Directors*, A. W. Tait, R. Hunter, G. Balfour, C. D. Geddes.

Felixstowe Pier Railway, Felixstowe. (The Coast Development Corporation, Ltd.) *Elec. Eng.*, E. A. Lambert.

Gateshead and District Tramways Company, Tramway Depôt, Sunderland Road, Gateshead, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Depôt, Gateshead; T.N., 125 & 408 Gateshead.] *General Manager*, William Morrison; *Secretary*, H. W. Davis; *Chairman*, H. S. Day; *Directors*, H. A. Stagg, C. R. Greene, J.P., Judge L. A. Atherley-Jones, K.C.

Giant's Causeway and Portrush Electric Tramway Company, Portrush. *Manager & Sec.*, W. McCurdy; *Elec. Eng.*, W. A. Traill; *Chairman*, J. S. Moore; *Directors*, A. B. Stuart, W. A. Traill.

Glossop Tramways, Electricity Works, Glossop (owned by the Urban Electric Supply Co.) [T.N., 34, Glossop.] *Manager and Res. Eng.*, C. E. Knowles; *Rolling Stock Supt.*, T. L. Podmore; *Secretary*, C. H. Jones; *Chairman*, P. D. Tuckett; *Directors*, E. Charrington, F. E. Gripper, H. B. Grotrian, D. Owen.

Gosport and Fareham Tramways, Tramways and Lighting Office, Gosport, Hants., and Moorgate Station Chambers, London, E.C. [T.A., Tramways, Gosport; T.N., 3, Post Office, Gosport.] *Eng. and Manager*, J. Fereday Glenn; *Sec.*, J. Barber Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

Gravesend & Northfleet Electric Tramways, Ltd., Tramway Depot, Northfleet, Kent, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 958, Gravesend.] *Manager*, P. R. Blake; *Sec.*, H. C. Walter; *Acting Sec.*, J. S. Bowker; *Chairman*, E. Garcke; *Directors*, W. L. Madgen, P.N. Gray, W. S. Wreathall.

Great Crosby Tramways, 31, James Street, Liverpool.

[This tramway is worked by the Liverpool Overhead Railway Company.]

Great Grimsby Street Tramway Co., Southampton House, Cleethorpes, and Moorgate Station Chambers, London, E.C. [T.A., Blanco, Cleethorpes; T.N., 16.] *Manager and Eng.*, H. L. White; *Elec. Eng.*, H. O. White; *Managing Director and Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P., D.L.; *Director*, S. Hern

Greenock and Port Glasgow Tramways Company, Ladyburn, Greenock, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramways, Greenock; T.N., 562]. *Manager*, A. Robertson; *Secretary*, P. N. Gray; *Chairman*, W. L. Madgen; *Directors*, G. J. Somerville, A. C. Miles, H. S. Day.

Guernsey Railway Company, Ltd., Hougue-à-la-Perre, Guernsey. *Manager and Elec. Eng.*, Arthur G. Bird; *Sec.*, J. de Mouilpied; *Chairman*, G. F. Peek; *Directors*, W. D. Murdoch, J. B. Collings, Q. Le Pelley, T. W. Palmer.

Hampshire Light Railway (Electric) Company, Ltd., Moorgate Station Chambers, London, E.C. *Secretary*, J. B. Glenn; *Chairman*, A. Beattie, J.P.; *Directors*, J. Barber Glenn (*managing*), S. Hern.

[This company works the Portsdown and Horndean Light Railway.]

Hastings Tramways Company, Ltd., Beaufort Road, Silverhill, St. Leonards-on-Sea, and 1, Queen Victoria Street, London, E.C. [T.A., Tramways, Hastings, and Enshrine, London; T.N., 90 Hastings, and 3465, City]. *General Manager and Elec. Eng.*, W. Vincent Edwards; *Secretary*, W. R. Elston; *Chairman*, G. Kitchen; *Directors*, J. C. Williamson, Dr. Moody.

Imperial Tramways Company, Ltd., Clare Street House, Bristol. *Secretary*, F. H. Withers; *Manager*, F. Freshwater; *Chairman*, S. White, J.P.; *Directors*, W. G. Verdon Smith (*Managing*), J. H. Howell, Sir G. Stanley White, Bart.

Isle of Thanet Electric Tramways and Lighting Company, Ltd., St. Peter's, Kent, and Moorgate Station Chambers, London, E.C. [T.A., Tramways, St. Peters, Kent; T.N., 29 Broadstairs]. *Gen. Manager and Elec. Eng.*, J. A. Forde; *Traffic Supt.*, A. L. Gardener; *Secretary*, J. Barber Glenn; *Chairman*, A. R. Monks; *Directors*, Lord Arthur Butler, H. Brown.

Jarrow and District Electric Traction Company, Ltd., Electrical Federation Offices, Kingsway, London, W.C. [T.A., Jarrow, c/o Tramway, London; T.N., 2686 Holborn.] *Traffic Manager*, G. McClelland; *Secretary*, C. W. Francis; *Acting Sec.* H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, W. Morrison (*managing*), H. S. Day.

Kidderminster & District Electric Lighting and Traction Co., Ltd., Kidderminster, and Electrical Federation Offices, Kingsway, London, W.C. [T.N., 108]. *General Manager*, W. G. Bond; *Secretary*, B. Kingsford; *Chairman*, E. Garcke *Directors*, J. A. Lycett, H. S. Day, W. L. Madgen.

Kinver Tramway, Kinver, and Electrical Federation Offices, Kingsway, London, W.C., *q.v.*, Dudley Stourbridge, and District Elec. Traction Co., Ltd.

Lanarkshire Tramways Company, Edinburgh Road, Motherwell, N.B., and 83, Cannon Street, London, E.C. [T.A., Tramways, Motherwell; T.N., 64.] *Gen. Manager and Eng.*, G. F. Moller; *Elec. Eng.*, E. H. Glennie; *Per. Way Eng.*, R. Foster; *Traffic Supt.*, J. L. White; *Sec.*, A. Clements: *Chairman*, A. R. Monks; *Directors*, Lord Carmichael, Sir B. Cunard, Bart., H. C. Levis, J. F. Nauheim.

Lancashire United Tramways Limited, Atherton, Lancs. [T.A., Tramways, Atherton; T.N., 36, Atherton.] *Gen. Manager and Engineer*, E. H. Edwardes; *Secretary*, ——————; *Chairman*, Hon. Sir A. Stanley, G.B.E.; *Directors*, J. M. Henderson, J.P., R. Watson, J.P., A. Adam, J. S. Austen.

Liverpool and Prescot Light Railway.—This line, which with the St. Helens Corporation Tramways forms the connecting link between the City of Liverpool and South Lancashire Tramways, is owned and worked by the Liverpool Corporation.

Liverpool Overhead Railway Company, 81, James Street, Liverpool. [T.A., Motor, Liverpool; T.N., 5463 Central.] *Gen. Manager and Eng.*, E. J. Neachell; *Secretary*, H. G. Alexander; *Chairman*, H. C. Woodward; *Directors*, J. E. Anderson, G. D. Killey, J. U. Hodgson, M. H. Maxwell.

Llandudno and Colwyn Bay Electric Railway, Limited, Tramway Depôt, Rhôs-on-Sea, Colwyn Bay, and Basildon House, Moorgate Street, London, E.C. *Gen. Manager*, Alex. G. Balfour; *Secretary*, A. W. R. Lovering; *Directors*, G. Balfour, A. W. Tait, T. Stoker.

Llanelly and District Electric Lighting and Traction Company, Ltd., Llanelly, and 66, Queen Street, London, E.C. *Engineer and Manager*, J. E. Stewart; *Secretary*, W. C. Bryden; *Chairman*, A. R. Holland; *Directors*, A. V. Anderson, M. A. Edwards, A. H. Beatty.

London and Suburban Traction Company, Ltd., Electric Railway House, Broadway, Westminster, London, S.W. *Secretary*, A. L. Barber; *Chairman*, Lord Stuart of Wortley; *Directors*, C. G. Tegetmeier, W. M. Acworth, W. C. Burton, E. Garcke, E. R. Soames, J. Devonshire (*managing*).

London United Tramways Ltd., Electric Railway House, Broadway, Westminster, London, S.W. [T.N., 6800, Victoria.] *Managing Director*, J. Devonshire; *Secretary*, A. L. Barber; *Gen. Manager*, C. J. Spencer; *Engineer*, A. V. Mason; *Traffic Supt.*, J. B. Mackinnon; *Chairman*, W. M. Acworth; *Directors*, Rt. Hon. Viscount Knutsford, F. V. Schuster, W. C. Burton, H. A. Vernet.

Luton Corporation Tramways (leased to and worked by Balfour, Beatty & Co., Ltd., 66, Queen Street, London, E.C.), Tramway Offices, Park Street, Luton. [T.N., 230.] *Engineer and Manager*, William W. Clark.

Mansfield & District Light Railway Co., Sutton Road, Mansfield, and 66, Queen Street, London, E.C. [T.A., Cars, Mansfield, T.N., 107.] *Eng. and Manager*, J. F. Dixon; *Secretary*, W. C. Bryden; *Chairman*, A. R. Holland; *Directors*, W. J. Chadburn, A. H. Beatty, G. Balfour, C. R. Walker.

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ELECTRIC TRAMWAYS IN THE UNITED KINGDOM

Manx Electric Railway Company, Ltd., 1, Strathallan Crescent, Douglas, Isle of Man, and 3, Finch Lane, London, E.C. [T.A., Electric, Douglas, Man.; T.N., 61.] *Gen. Manager & Eng.*, F. Edmondson; *Secretary*, J. Featherston; *Chairman*, Sir W. H. Vaudrey; *Directors*, B. E. Greenwell, E. Remnant, C. A. Huni.

Merthyr Electric Traction and Lighting Company, Ltd., 53, Pontmorlais Circus, Merthyr, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Company, Merthyr; T.N., 0180, Merthyr Tydfil.] *Managing Eng.*, L. W. Dixon; *Secretary*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, W. L. Madgen, E. R. Soames.

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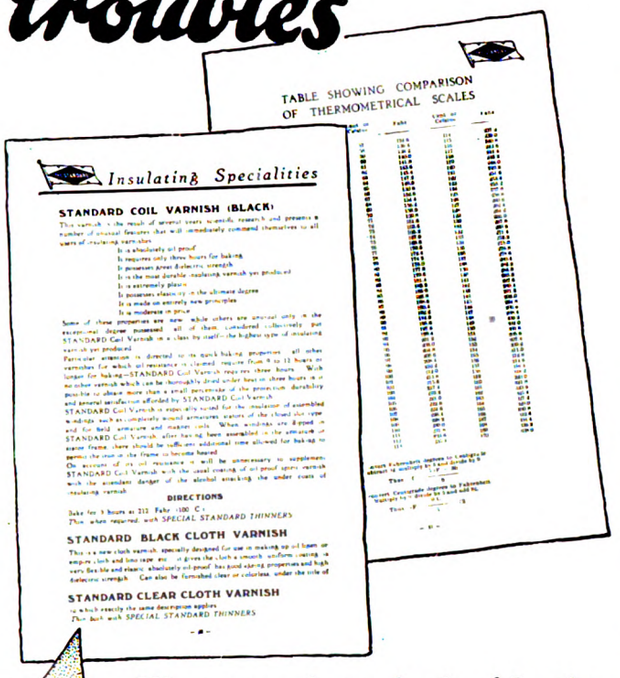

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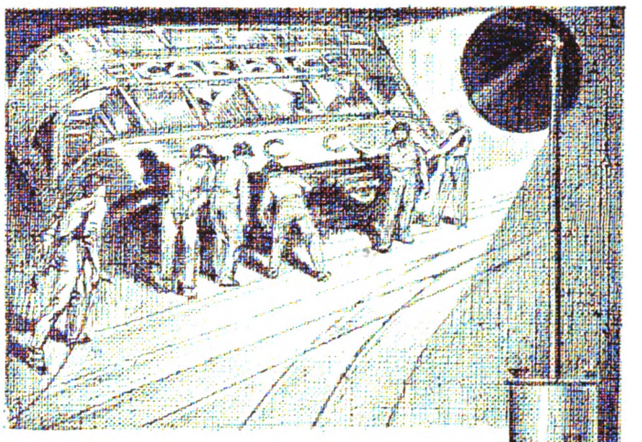

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Merthyr Electric Traction and Lighting Company, Ltd., 53, Pontmorlais Circus, Merthyr, and Electrical Federation Offices, Kingsway, London, W.C. [T.A., Tramway Company, Merthyr; T.N., 0180, Merthyr Tydfil.] *Managing Eng.*, L. W. Dixon; *Secretary*, H. A. Stagg; *Chairman*, G. J. Somerville; *Directors*, C. G. Tegetmeier, W. L. Madgen, E. R. Soames.

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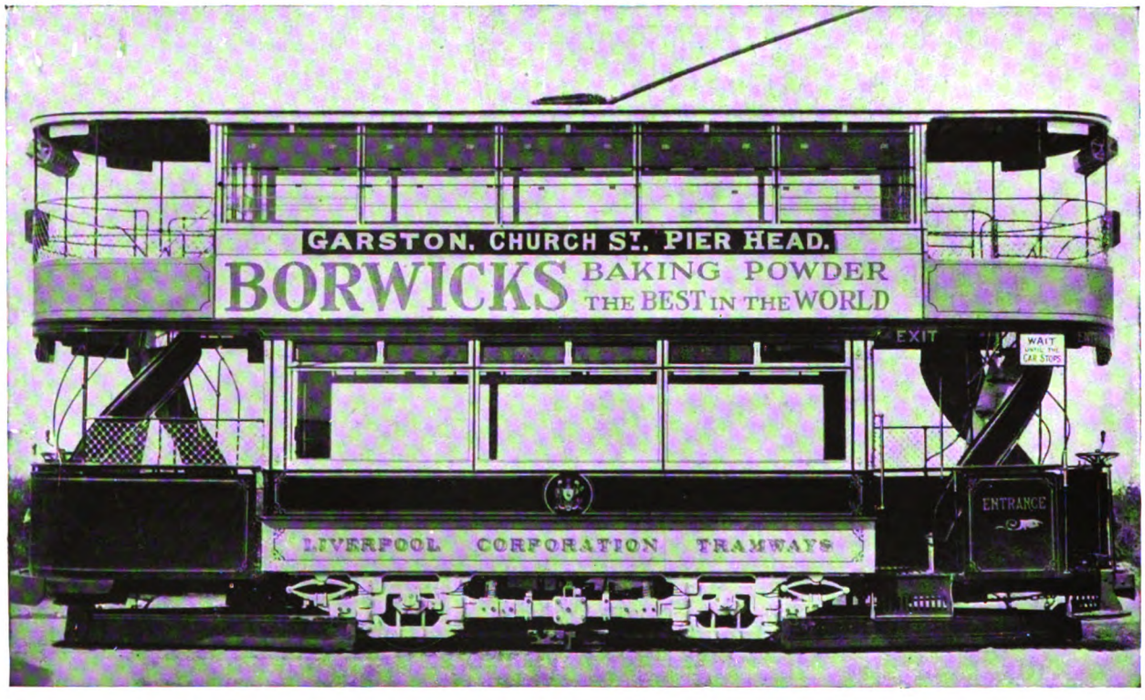

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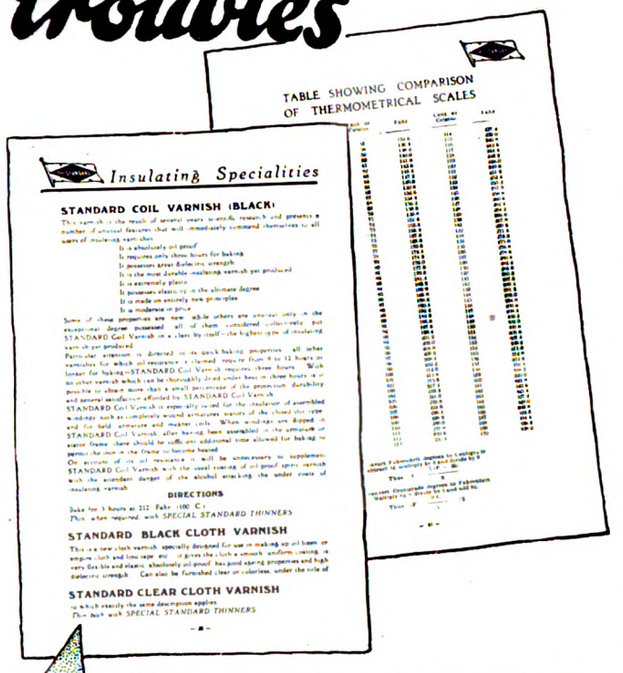

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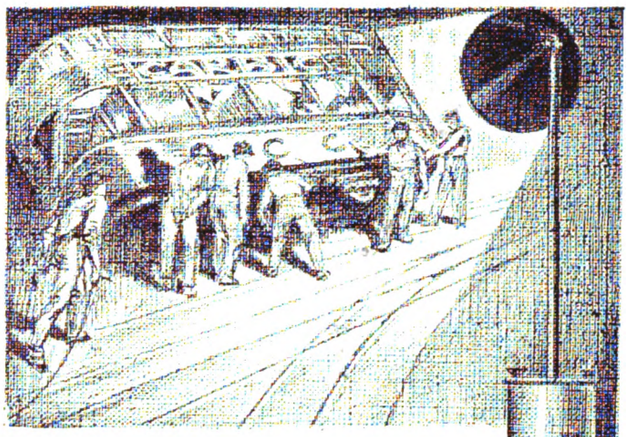

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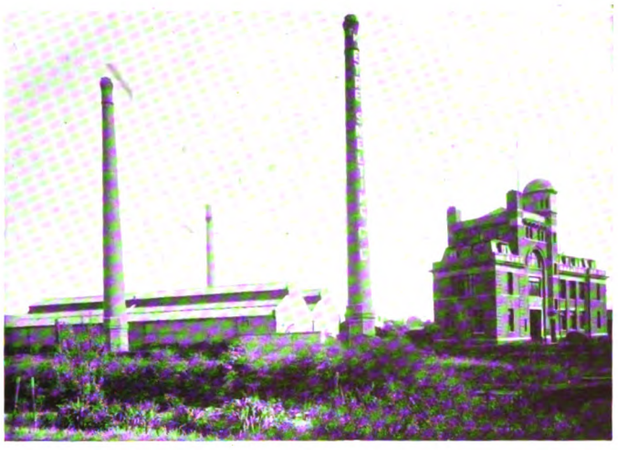

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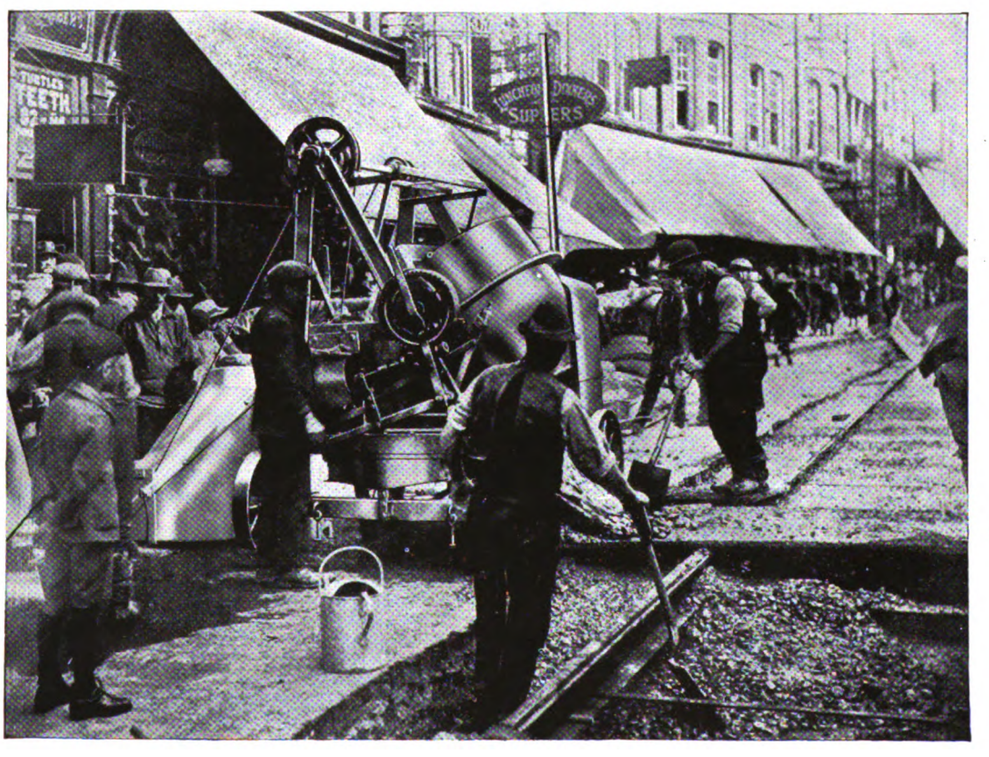

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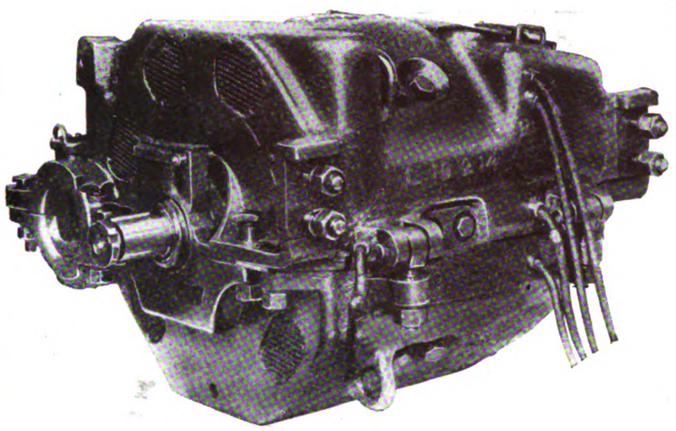

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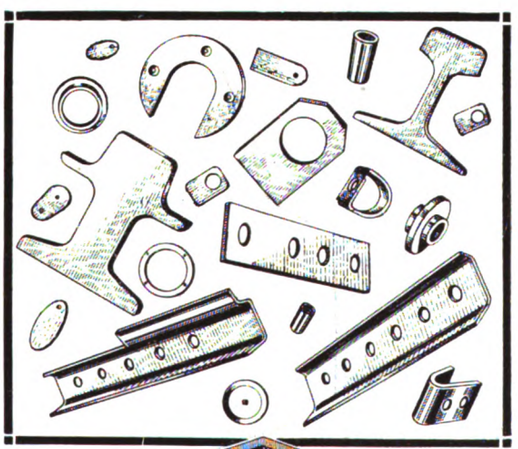

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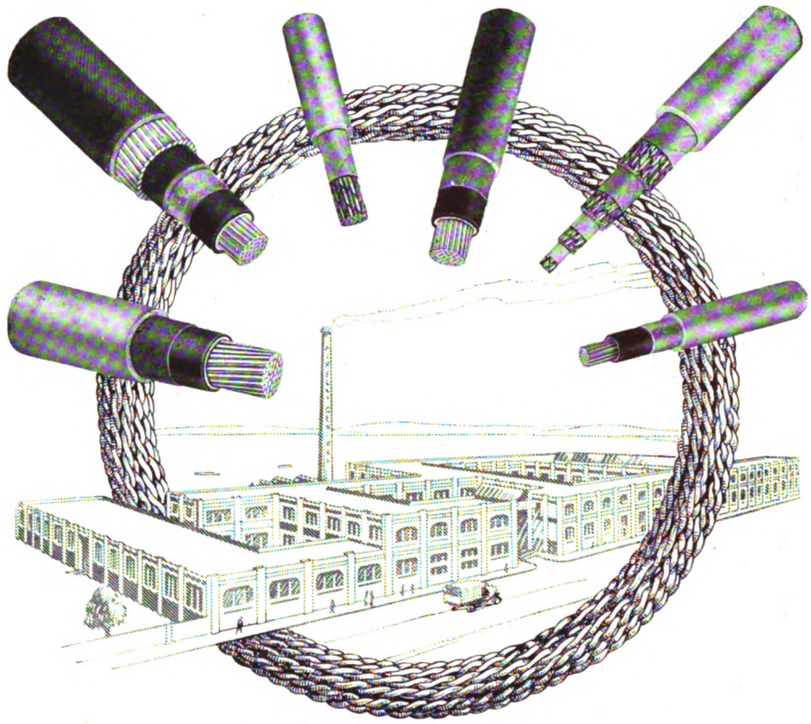

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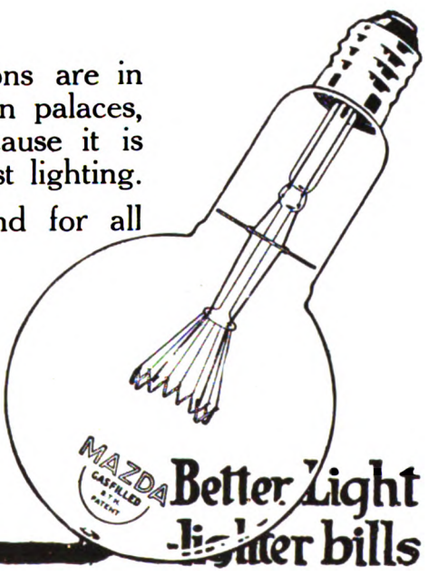

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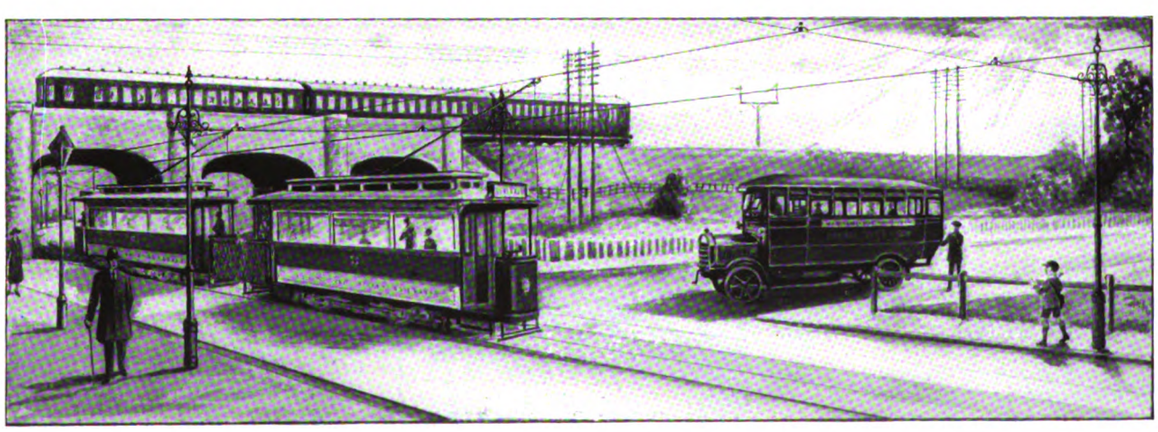

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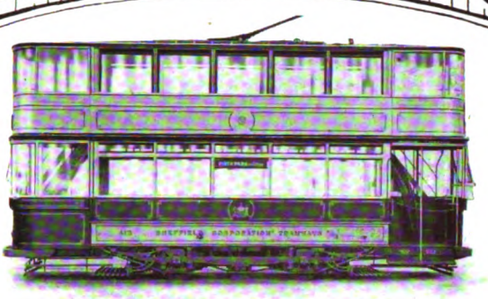
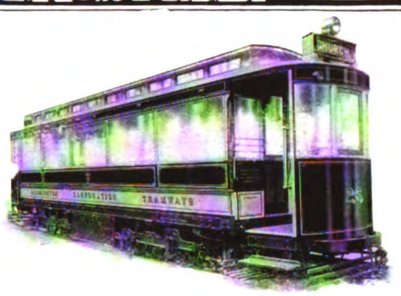
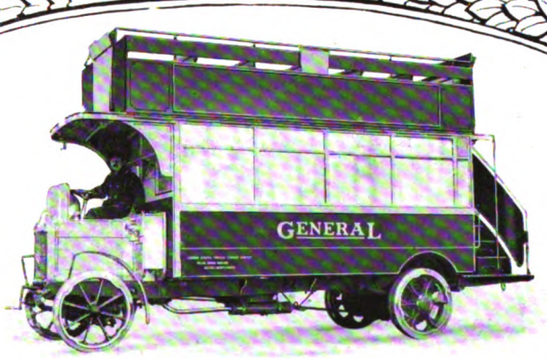


Double-Deck Tramcar



Single-Deck Tramcar

Motor Omnibus—Interurban Type



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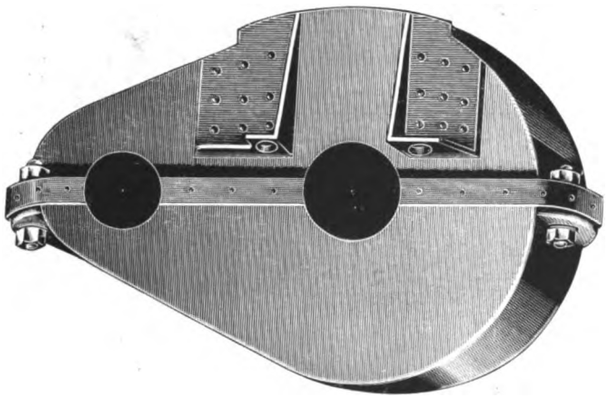

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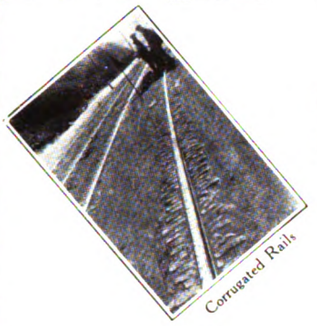
Corrugated Rails

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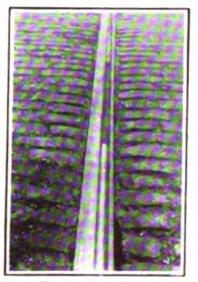
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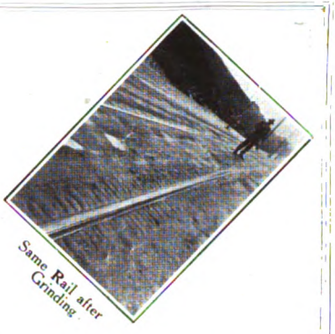
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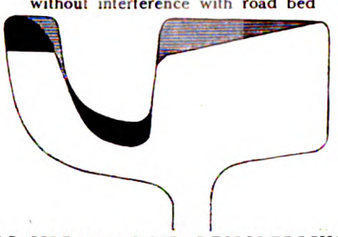

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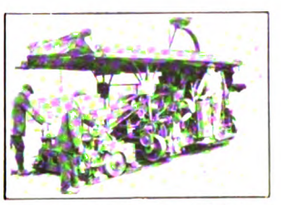
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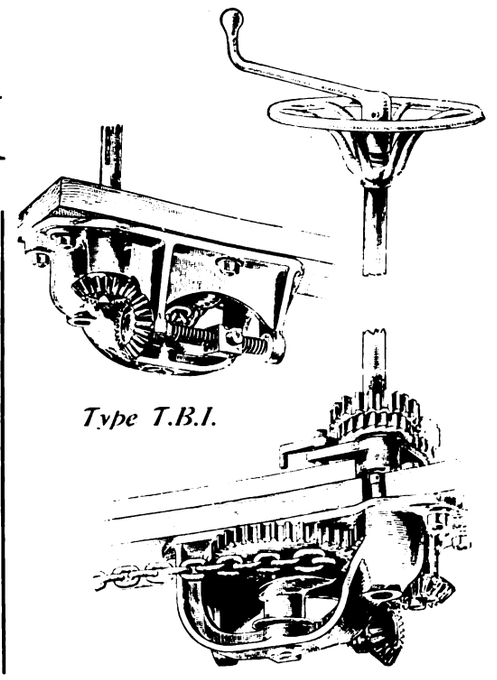

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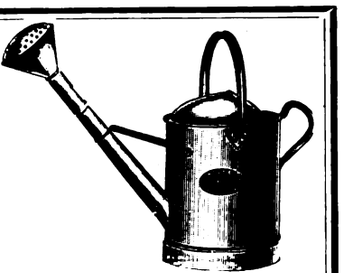
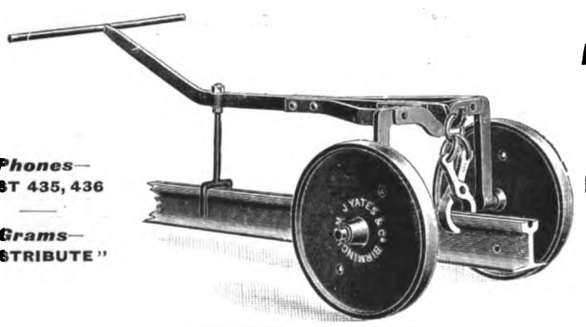


TRAM TOOLS



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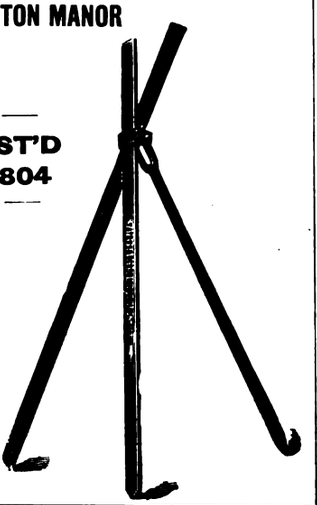

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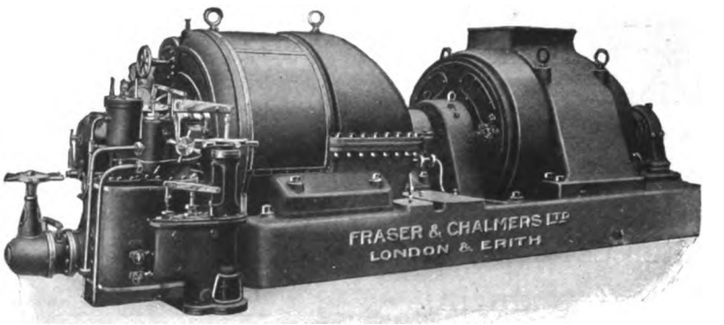

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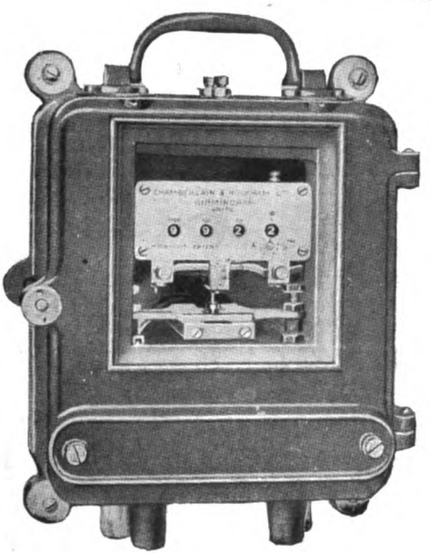

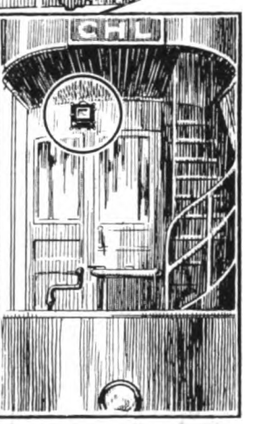

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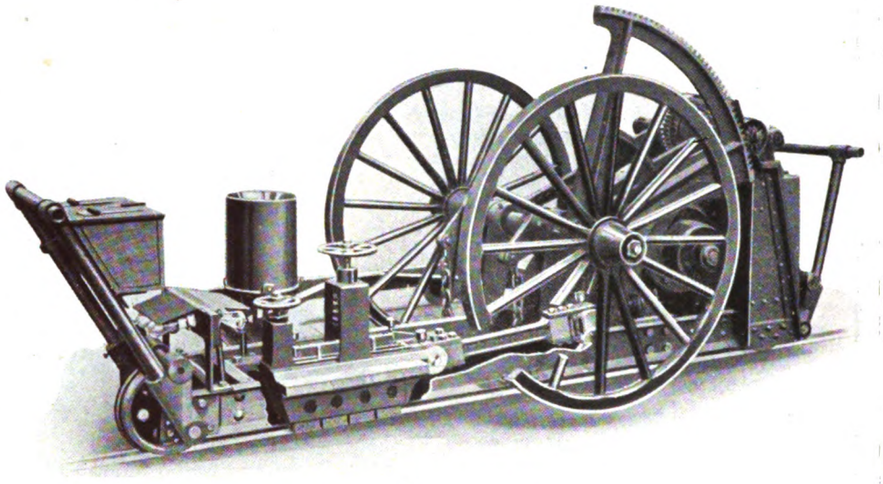

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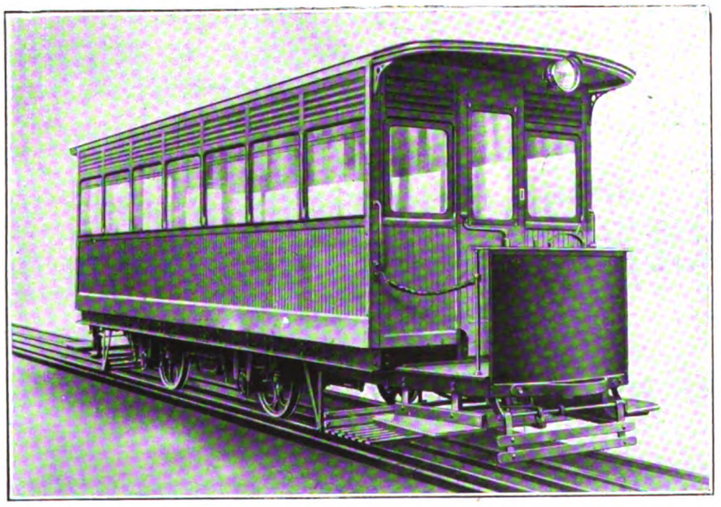

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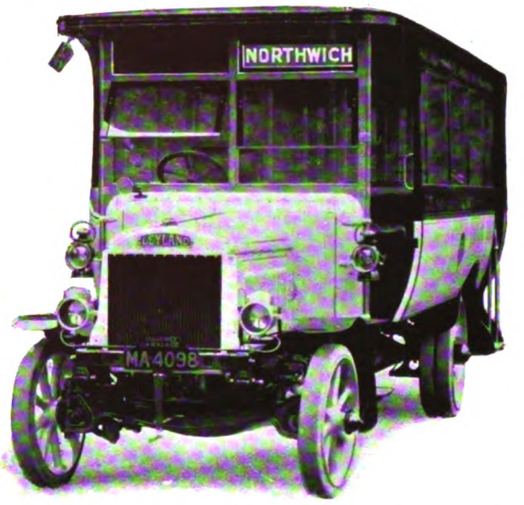

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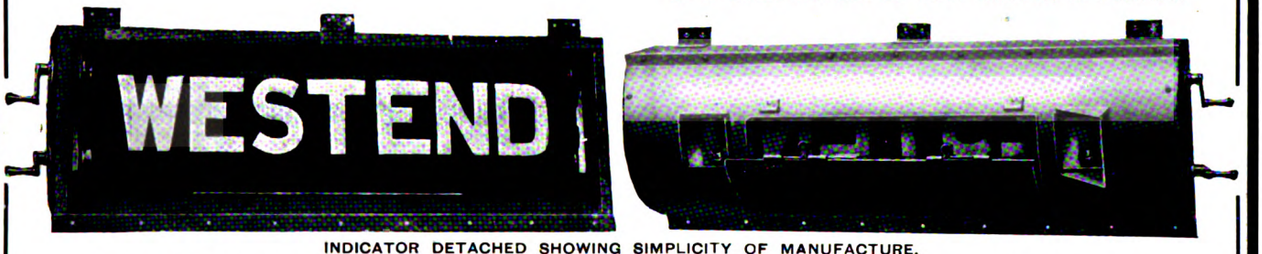

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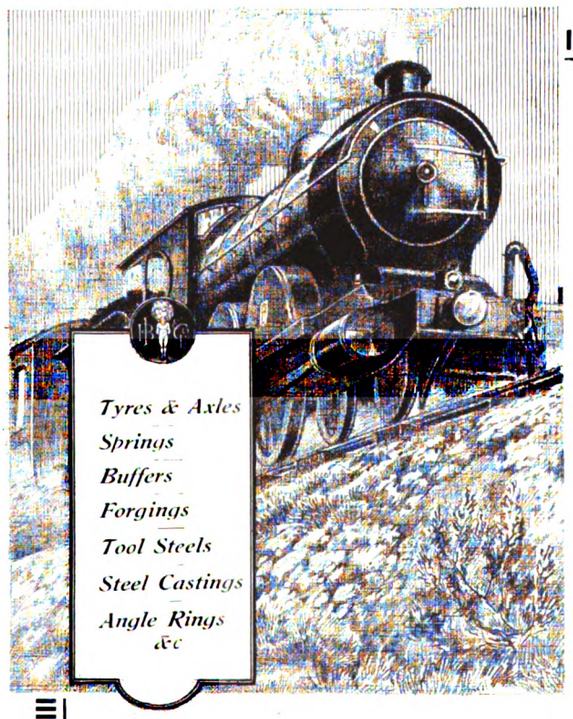

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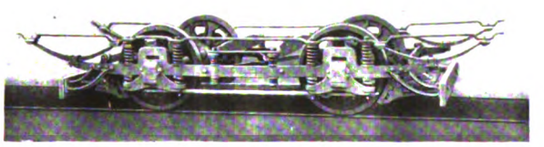
Semi-elliptic spring cap 3490.
Journal coil spring cap C.407.
Motor support spring cap and seats 2721.
Equalising lever fulcrums C.1289 (bushed).
Pull lever castings 3192.
Brake beam fulcrums, 3194.
Journal box lids B.435
Brake Hanger Holder 3163.
Brake Shoe Holder C.5145, for interchangeable shoe.



THE J. G. BRILL COMPANY
150 Southampton Row LONDON W C 1
'Phone **MUSEUM 5313** *Telegrams* **"AXLES LONDON"**

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Announcement

We have pleasure in notifying that we are producing throughout in our own works the following grades of Gears and Pinions

Gears Grade P.H. — Carburised Steel. Dead hard the full working depth of tooth. Split or solid.
Supreme for Tramway Work if run with Pinions Grade C.H.

„ „ X — Ordinary Steel gears. Split or solid.

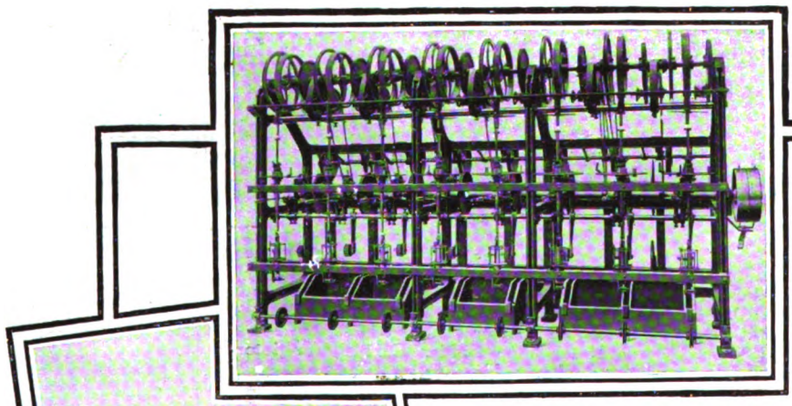
Pinions „ A — Siemens Martin Steel, 40 tons tensile individually hammered blanks. Steel in forged state—not heat treated or hardened.

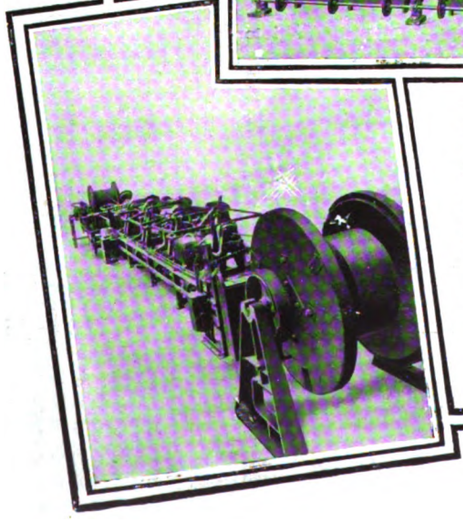
„ „ C.H. — Siemens Martin Steel, special quality, carburised dead hard the full working depth of the tooth.
Supreme for Tramway Work if run with Gears Grade P.H.

„ „ N.C. — High tensile Nickel Chrome Steel, heat treated and oil tempered (not carburised). Specially suitable where teeth are highly stressed as in railway work.

Pre-War Hardened gears and pinions cost twice as much as the ordinary grade. To-day they cost only about 50% more and therefore shew a still more marked economy in cost per mile run.

The Electro-Mechanical Brake Co. Ltd.
West Bromwich England Established 1908





In the making of V.I.R. Cables

The two types of Machine illustrated are used for the purpose of taping the Rubber Insulated Conductors with a helical binding of best quality India-Rubber Coated Cotton Tape—that on the right being used for so treating Cables and Wires of the lighter type, and that on the left for heavier Cables.

These are "Mass Production" Machines, the essentials kept in view in their design being high-speed working, longest uninterrupted runs and, therefore, maximum output. Both types will be as familiar to our competitors as to ourselves—they have found it to their advantage to order similar machines from us in very large numbers. And, again, this points to the certainty of "that little more" in quality—that super-excellence—which characterises all J. & P. Cables, and naturally follows from our unique experience combined with a consistent policy of "quality first."

NOTE.—V.I.R. CABLES, BEARING THE J. & P. MARK, CAN BE DELIVERED FROM STOCK AT WORKS AND BRANCHES

JOHNSON & PHILLIPS Ltd. Charlton London S.E.7.

City Office—12 Union Court Old Broad Street EC2

Branches at BIRMINGHAM CARDIFF GLASGOW MANCHESTER NEWCASTLE-ON-TYNE PORTSMOUTH and SWANSEA

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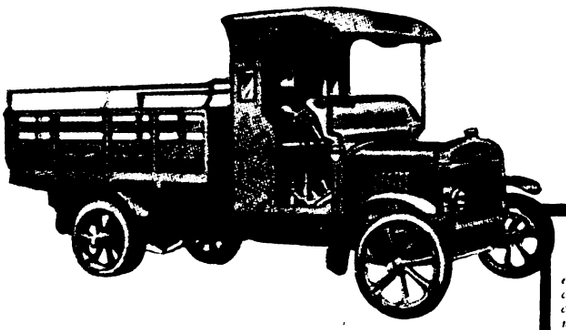


Chemical and Physical Testing Laboratory at your disposal

A Testing Laboratory fully equipped with physical and mechanical testing machines and chemical apparatus is established under a fully qualified chemist and metallurgist at our Works. This Laboratory is primarily for the testing of the raw materials used in the manufacture of our Chassis. We invite communications from our customers and friends of any tests or investigations they may wish to have carried out.

A Paying Proposition

THE Tilling-Stevens Petrol Electric has dispensed with the need for clutch and gears. The result is greater simplicity of control, smoother starting, quieter running. Long engine and tyre life are the salient consequences.

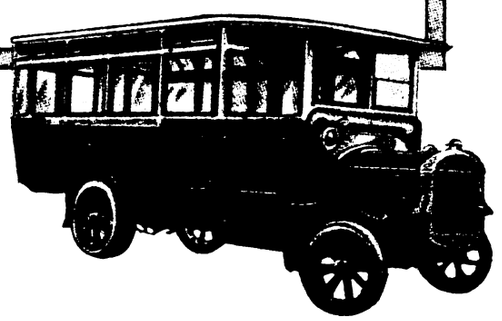
For hilly districts, the Tilling-Stevens Petrol Electric is ideal. It can never run backwards, the power being continuously transmitted to the road wheels, and the dangers of de-clutching are obviated. An easy, silent start on the stiffest gradient is another important feature.

Viewed from all points, the Tilling-Stevens Petrol Electric is the vehicle best calculated to benefit you.

Tilling-Stevens Motors Ltd.,
26 Victoria Street, Westminster, S.W.1.

Phone— VICTORIA 4939.

Wires— "PETELOBUS, VIC, LONDON."



TILLING-STEVENS MAIDSTONE

REPRESENTATIVES AND THEIR TERRITORIES.

S.E. Counties—
ROOTES LTD.
Len Engineering Works,
Maidstone.

Yorks.—
THORNTON ENGINEERING CO. LTD.
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Scotland—
THE HUGHES MOTOR ENGINEERING CO. LTD.
113 George Street Edinburgh.

Lancs. & N. Wales—
C. F. RYMER LTD.
Cunard Building Liverpool.

Midland Counties—
MIDLAND COUNTIES MOTOR GARAGE CO. LTD.
33-34 Paradise Street Birmingham.

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NICKELS LTD.
Chichester Street,
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Co. Durham—
C. F. RYMER LTD.
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The Shrewsbury S.T. & Challiner Tyre Co. Ltd.
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(READY FOR SERVICE)

AT LIGHT CAR PRICES

A large fleet of 30 h.p. "B" type omnibuses are offered for sale.

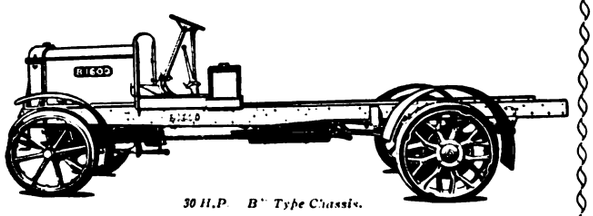
COMPLETE BUS with 34 Seat D.D. Body and Electric Lighting Set **£500** AT OUR WORKS

CHASSIS ONLY - - **£450** AT OUR WORKS

GUARANTEE.

All vehicles are second-hand, have been thoroughly overhauled within 6 months of date of sale by the L. G. O. Co. and carry the same guarantee as our new vehicles.

We invite the inspection of interested potential buyers.



30 H.P. B" Type Chassis.

For further particulars apply:

ASSOCIATED EQUIPMENT CO., LTD.

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Telephone: Walthamstow **780** (9 lines).
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BRITAIN'S BIGGEST BUS BUILDERS.

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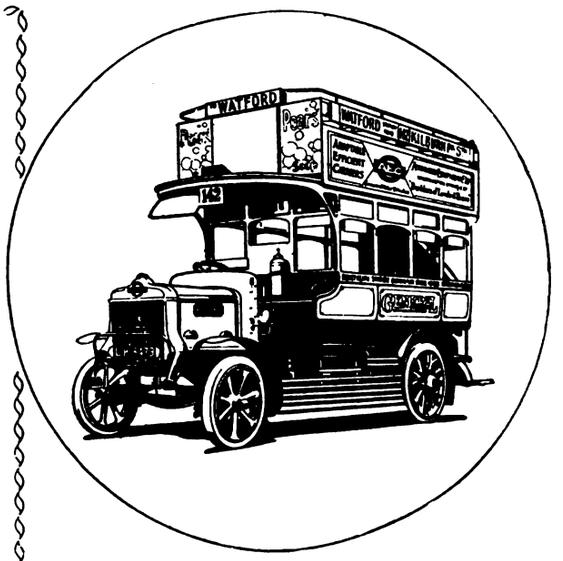

With Lorry Body substituted, these vehicles will give many years of efficient service for goods transport work. CAPACITY 2 TONS.

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EASY TO START
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VERY ACCESSIBLE
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HIGHER EFFICIENCY *between* THE ROAD *and* THE LOAD

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OMNIBUSES
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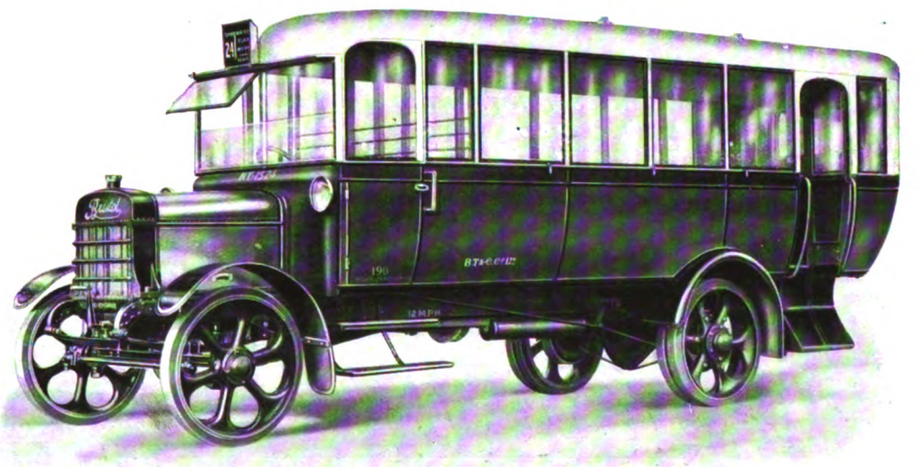

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ACCUMULATORS Limited

Telephones— Paddington 5120 (6 lines) 15 UPPER GEORGE ST. LONDON, W.1. *Telegrams—* "Edibatt Edge London"

ANNOUNCEMENT

Messrs. Edison Accumulators Ltd., appreciating the necessity of severing their BATTERY *business from the* ELECTRIC VEHICLE *department, and thereby enabling them to concentrate upon the numerous applications of the Edison Accumulator, have formed a Company under the title of* ELECTRICARS LTD. *This Company will in future carry on the important research work and manufacture of all classes of* BATTERY-DRIVEN VEHICLES. *Large and up-to-date works have been acquired, situate at Landor Street, Birmingham, where a steadily increasing output is being maintained.*

In future all enquiries referring to the supply of VEHICLES, TRUCKS *or* SPARE PARTS, *should be addressed to—*

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INDUSTRIAL MOTORS
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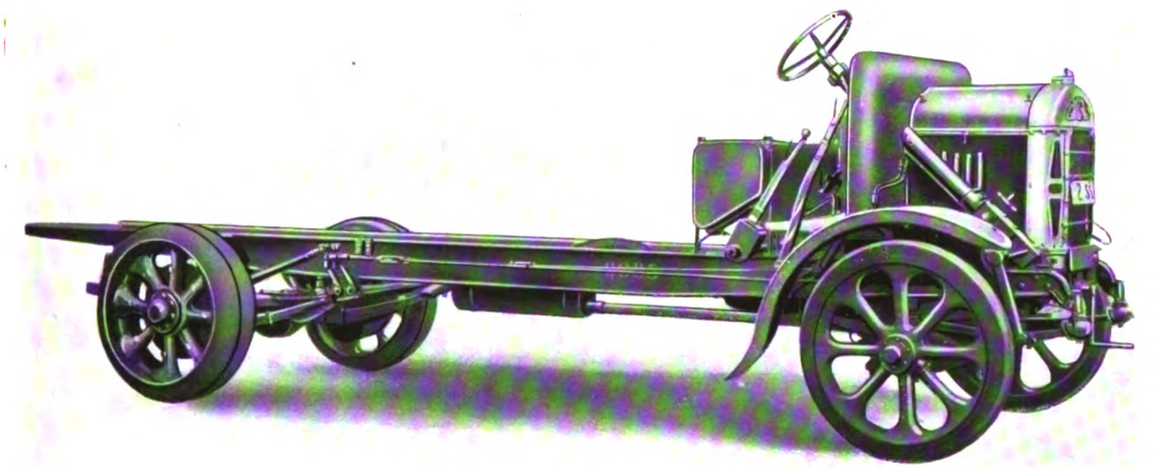

STRAKER-SQUIRE 55-H.P. "A" TYPE CHASSIS

THE STRAKER-SQUIRE "A" Type Chassis is designed for useful loads of from 3 to 5 tons, exclusive of body weight. For passenger vehicles a clear length of frame of 17 ft. 4 in. can be obtained without excessive overhang. It is the ideal chassis for single-deck omnibus and char-a-bancs bodies.

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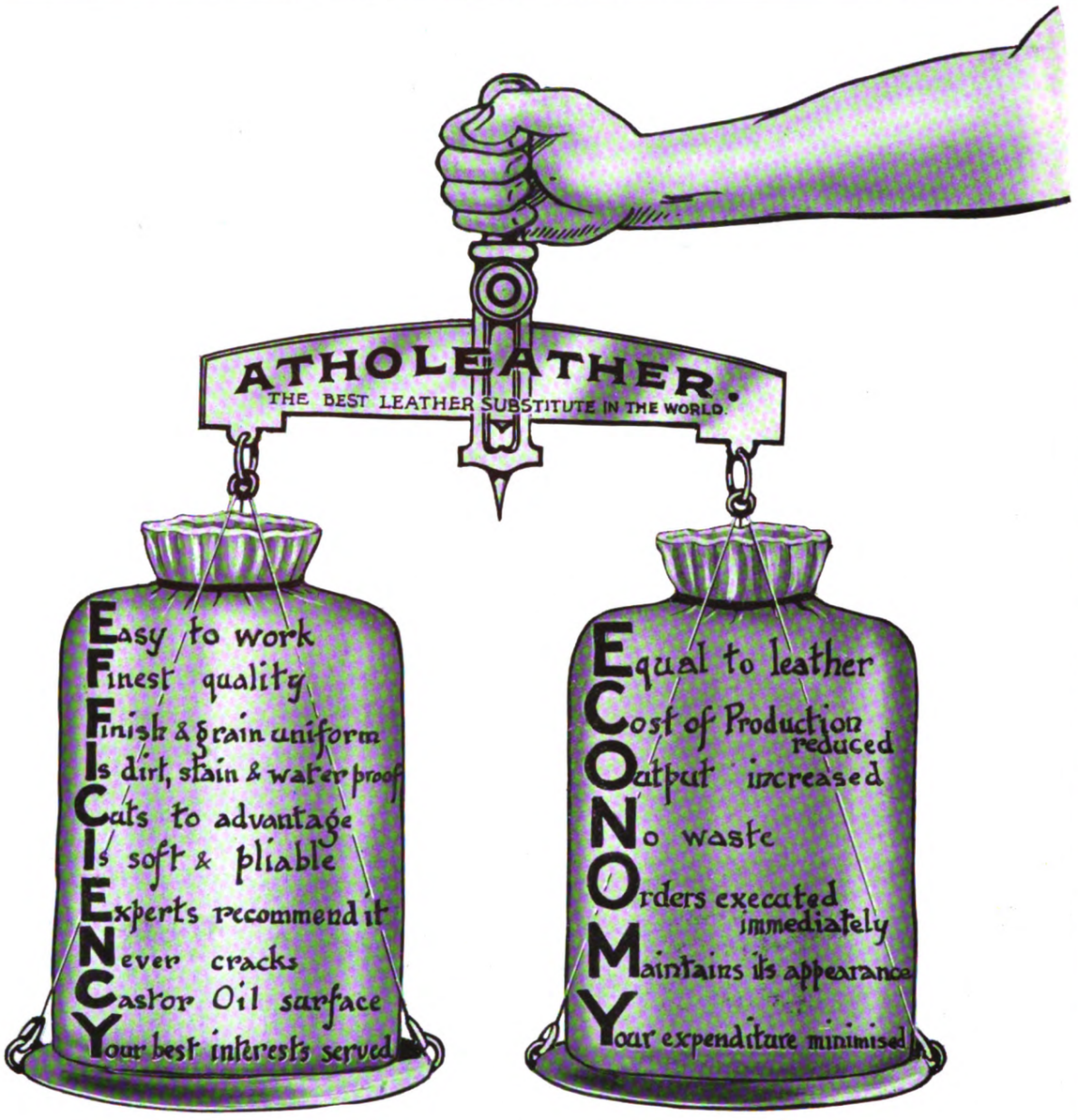

NOW that the question of reduction in selling price is becoming a vital one, it is a matter of supreme importance to select materials which give maximum service at minimum cost.

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LARGE STOCKS. IMMEDIATE DELIVERY
SAMPLES SENT AT ONCE ON REQUEST

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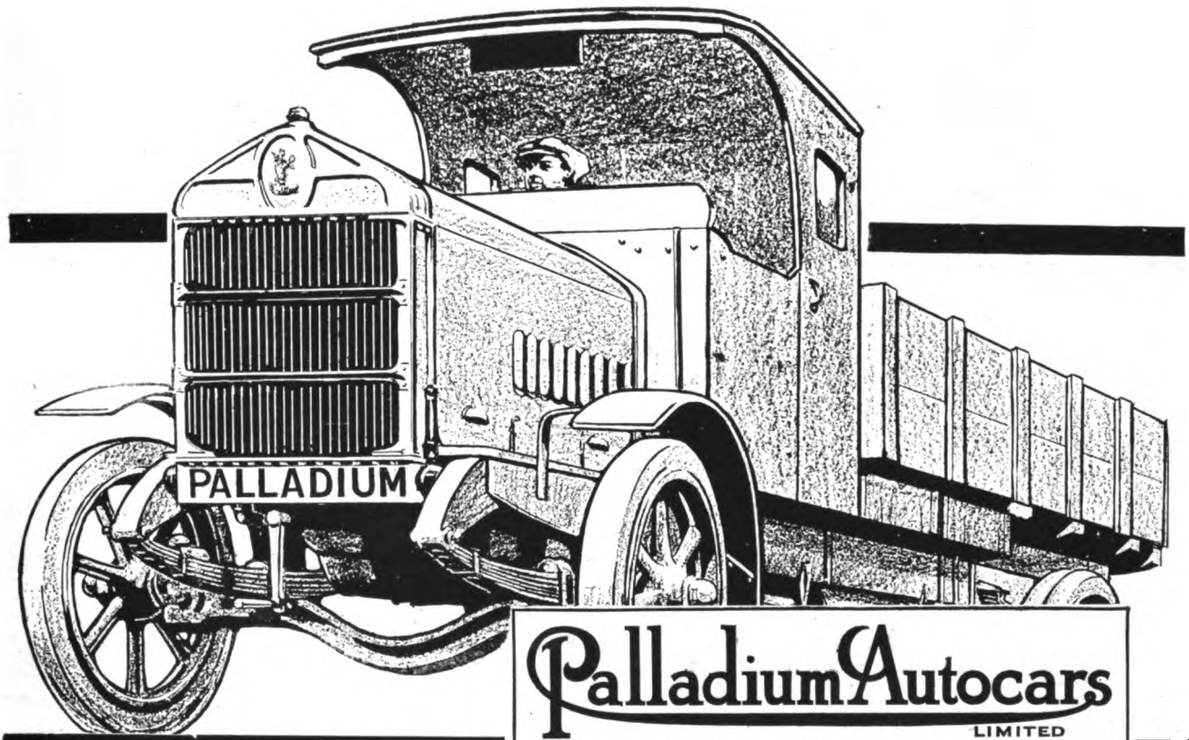
ASK ANY ROAD HAULAGE EXPERT

The heavy motor vehicle of the future will be run as smoothly and comfortably on solid tyres as the most luxurious touring car on pneumatics. It will be identical with the

PALLADIUM DOUBLE-CANTILEVER SUSPENSION MODEL

This new double-cantilever spring absorbs all road-shocks, damps out vibration, and cuts out side-sway and heeling over. It has revolutionised road transport

THERE IS A BIG DEMAND. PLACE YOUR ORDER NOW



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PUTNEY, LONDON, S.W.15.
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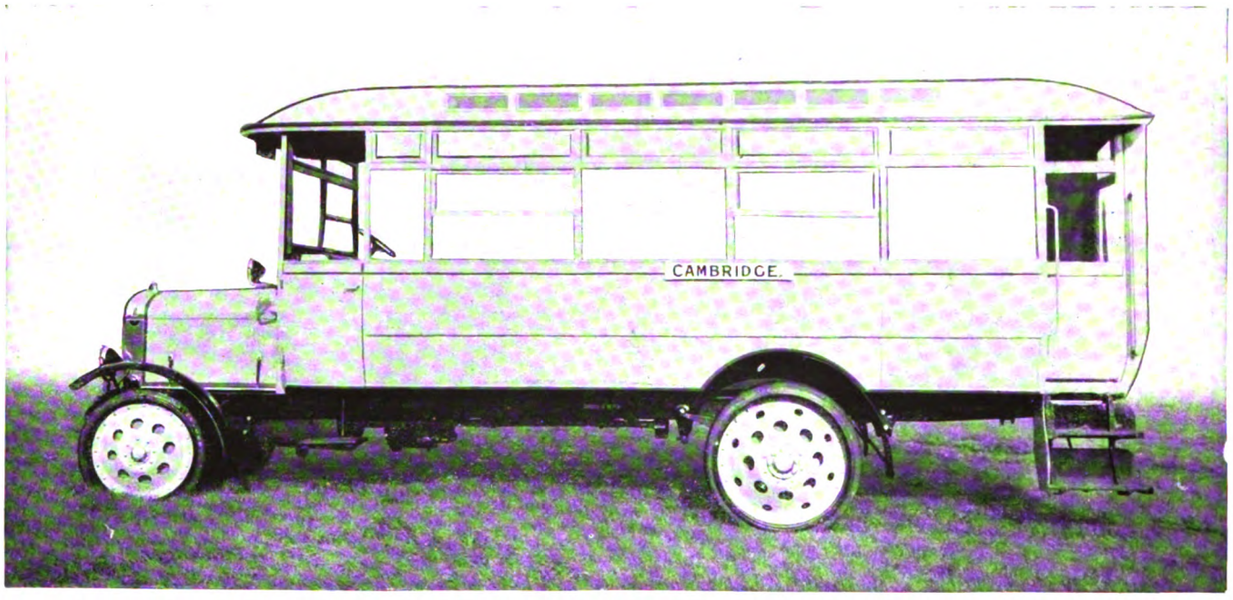

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THE FODEN
Driver
is a
Happy Driver

His
Smooth Running
Wagon
makes him so

To Get the TRUTH Consult the User

It's the only way to get unbiassed advice. It's a real good plan to ask the user—a plan easy to follow, because there are more FODENS on the road than any other makes. Your own eyesight will prove this statement.

Think over the following couple of Foden Facts; they'll help you to decide: "There were more Fodens used by the Government during the War than all other makes combined. The Foden Steam Wagon Works is the Largest in the World."

HERE IS WHAT USERS WILL TELL YOU—
FODENS are cheapest on Fuel—cheapest on Upkeep—cheapest on Repairs.
FODENS will stand more rough usage than any other wagon.

These are Foden Facts beyond dispute—not our statements, but the statements of users—the users who have tested all that the market has to offer.

We have the Largest Steam Wagon Works in the World at Sandbach, Cheshire, where every part of the FODEN is made, NOT MERELY ASSEMBLED. Satisfied users have placed us, by constant repeat orders for FODENS, in this position of UNCHALLENGEABLE SUPREMACY. If you are looking for REALLY CHEAP road transport it's a good plan, when in doubt, to ask the user. He knows.

GET THE FODEN BOOK. It gives the Foden facts and figures. It convinces because it gives the real proof—the users' testimony. To Business Heads it is free and post free.

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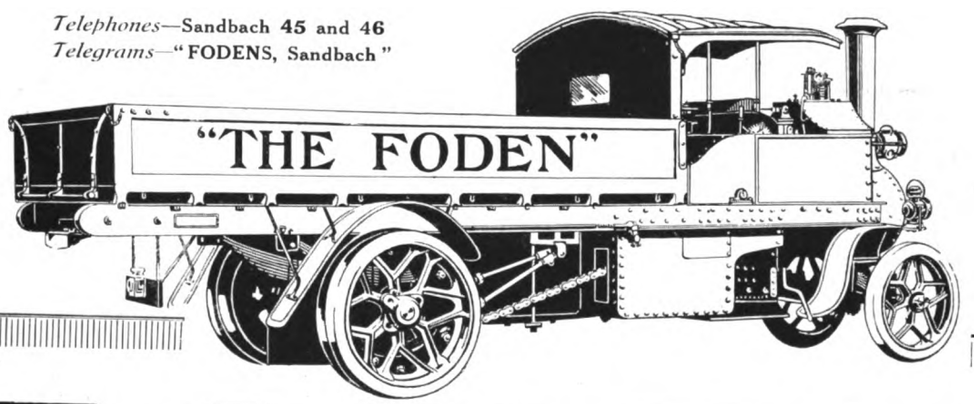
Telegrams—"FODENS, Sandbach"



FODEN
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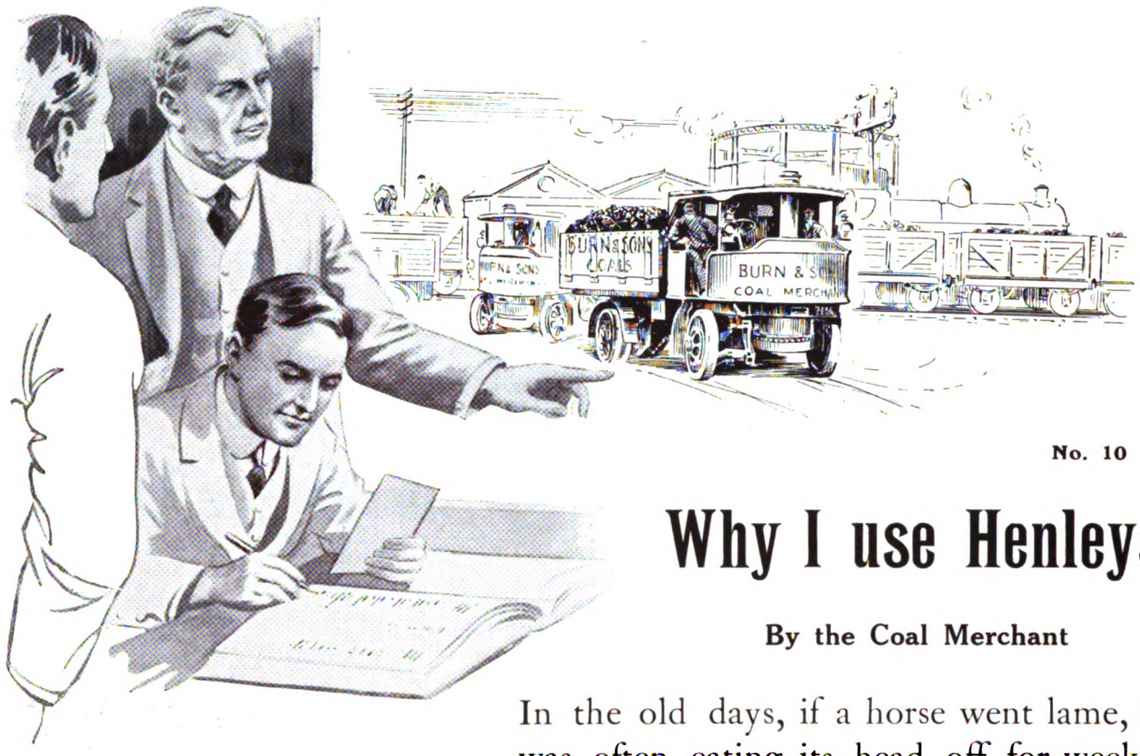

No. 10

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By the Coal Merchant

In the old days, if a horse went lame, it was often eating its head off for weeks, and our delivery service was seriously disorganised. We cannot afford that now, for we are doing nearly ten times the business we did formerly. In spite of the heavy loads carried, breakdowns are rare. We think this is chiefly due to the Henley Tyres which are fitted to all our vehicles. Our experiments have proved that Henleys are not only remarkably resilient, but that they give exeptionally good wear. We have frequently recommended them to our business friends.

Why not use a "WHY NOT"? the Longest Driving Golf Ball on the Market

Write for Quotations and Booklet "Evidence"

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SOLID RUBBER BAND TYRES

HENLEY'S TYRE & RUBBER CO. LTD.
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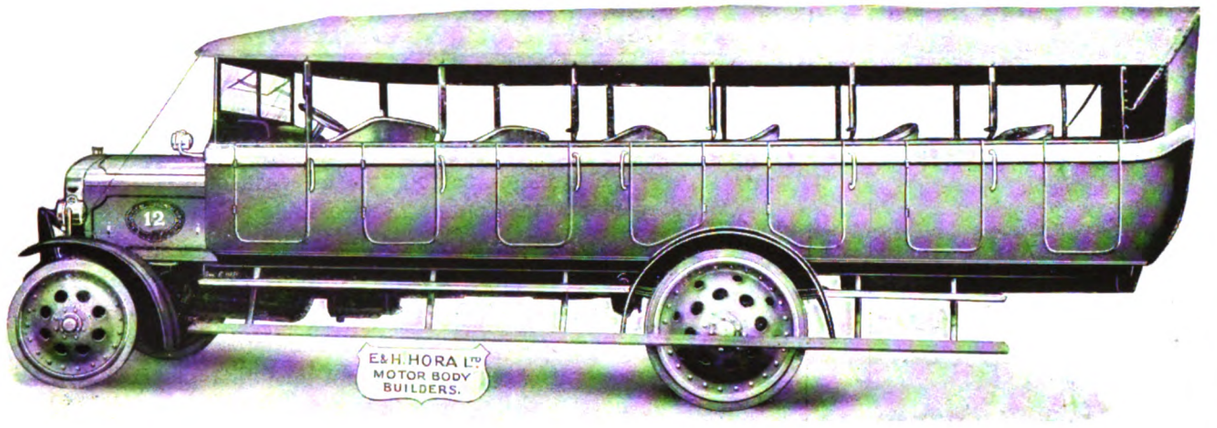
E. & H. HORA LTD

Omnibus and Char-a-banc Builders



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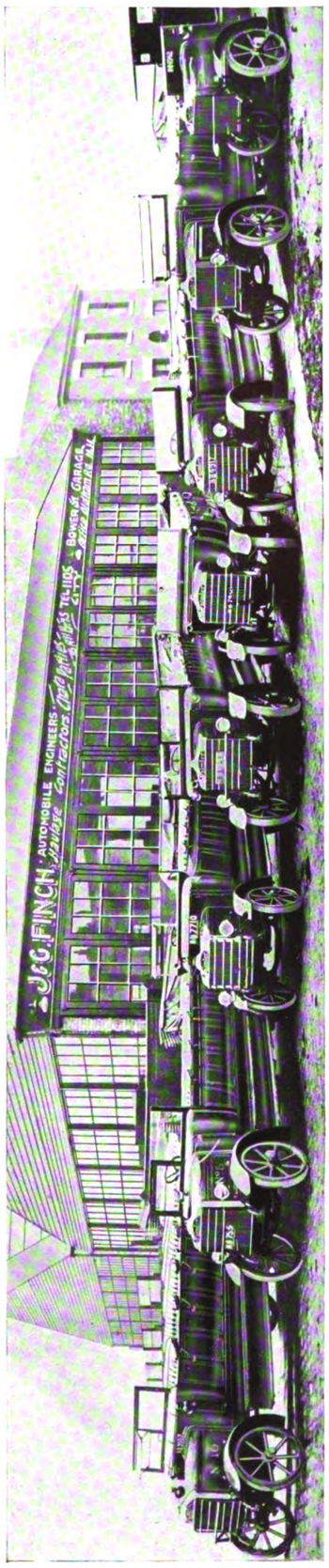

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——Avon Solid Tyres provide smooth, effortless traction which has a direct and demonstrable influence upon riding comfort, reduction of chassis wear and tear, petrol consumption, and every other factor of efficiency and economy in road transport.

Another *User's* Opinion

Newton Heath Manchester
30th Sept. 1920

Dear Sirs

We enclose photograph of part of our fleet of Chars-a-bancs and Lorries that we think might interest you.

All these vehicles are shod with Avon Tyres, and we have been using your tyres with every satisfaction for a good few years now.

We always fit Avons as standard on all Lorries and Chars-a-bancs that we sell, as we think they compare most favourably with any other make.

Yours faithfully
(Signed) J. & G. Finch

Are YOU getting tyre service at Avon cost-per-mile?

35 AVON SOLIDS, RUN BY DIFFERENT USERS, AVERAGED 15,284 MILES EACH.

AVON
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Works (Est. 1885)—MELKSHAM and BRADFORD-ON-AVON, Wilts.
Stock and Service Depots at Manchester, Leeds, Liverpool, Newcastle-on-Tyne, Glasgow, Aberdeen, Birmingham, Nottingham, Bristol, Swansea, Dublin and Belfast.

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P.E.V. Ltd

Stevens Petrol-Electric Vehicles

The extremely flexible electric transmission ensures longer life of Chassis

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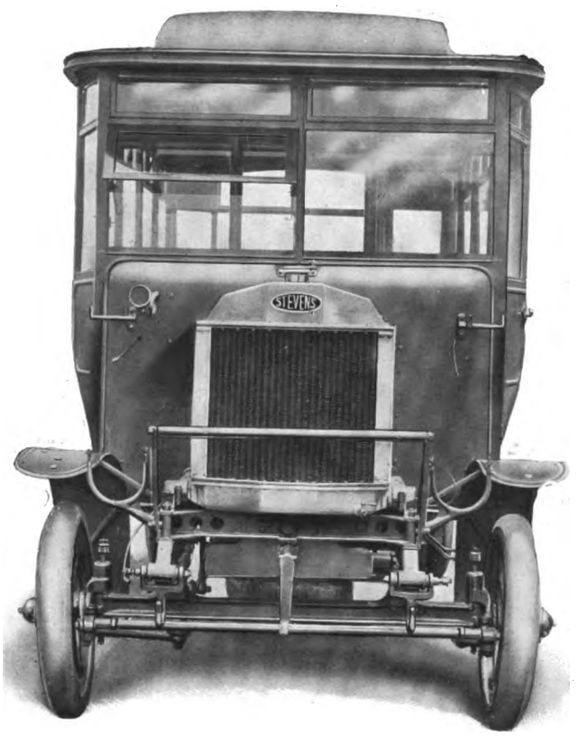

A "STEVENS" OMNIBUS RUNNING AT WALSALL

Greater comfort for Passengers Greater Tyre mileage, and Ease of Control

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STEVENS PETROL-ELECTRIC VEHICLES LTD.

(Managing Director, W. A. STEVENS)

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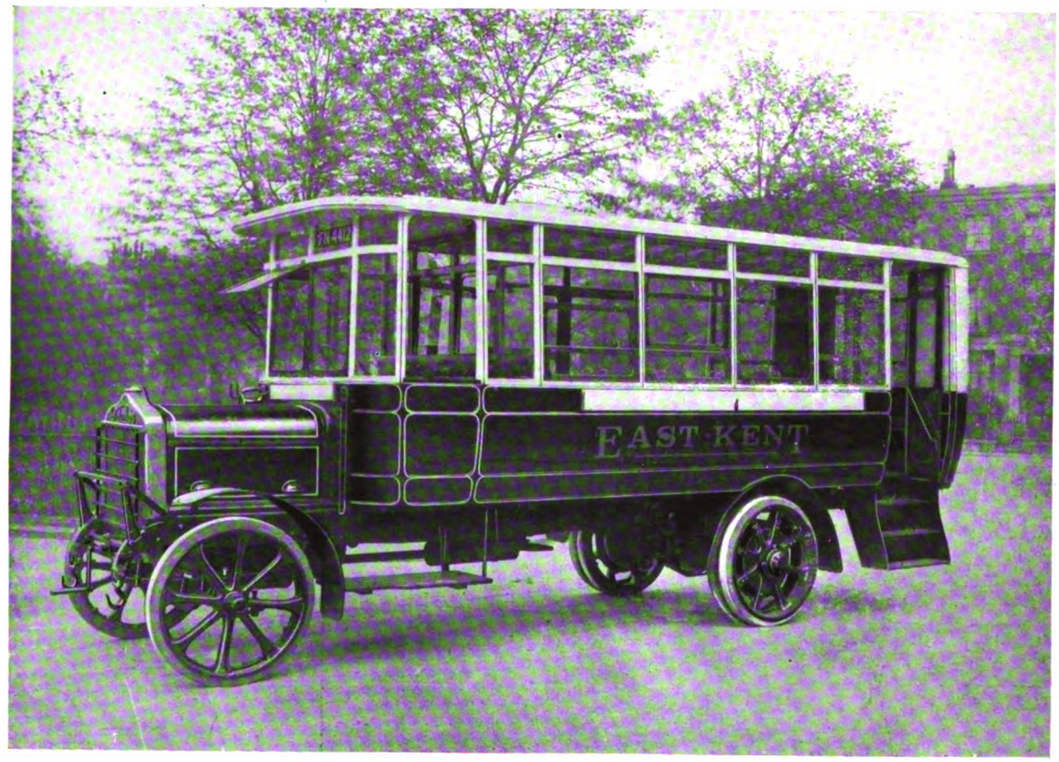
Single and Double-deck

MOTOR OMNIBUS BODIES



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THE Construction of our Bodies is based upon the experience we have gained as Operators of Public Service Vehicles since 1851. Our experience is at your service. Let us know your requirements.

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and their properties
No. 3.
DURABILITY

THE question of balancing the properties of resiliency and strength in a solid rubber tyre, is one of some little difficulty, but the addition of a *third* requirement—resistance to abrasive wear—increases the problem out of all proportion.

This is where the Dunlop *specialists*—chemists, engineers, operatives—combining the longest experience in tyre manufacture, assert Dunlop superiority, and without detriment to the properties already attained, produce in the Dunlop a tyre that gives unequalled mileage and is therefore the *cheapest* on a miles-for-money basis.

DUNLOP RUBBER Co., Ltd.
Founders of the Pneumatic Tyre Industry,
BIRMINGHAM.

DUNLOP SOLID RUBBER TYRE FITTING DEPOTS: Belfast, Birmingham Bristol, Coventry, Dublin, Edinburgh, Glasgow, Leeds, Liverpool, London, Mancheste , Newcastle-on-Tyne, Norwich, Nottingham.

Dunlop solid rubber tyres are obtainable from all leading motor dealers.

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FOR

GOODS OR PASSENGERS

——Avon Solid Tyres provide smooth, effortless traction which has a direct and demonstrable influence upon riding comfort, reduction of chassis wear and tear, petrol consumption, and every other factor of efficiency and economy in road transport.

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P.S.V. Ltd

Stevens Petrol-Electric Vehicles

The extremely flexible electric transmission ensures longer life of Chassis

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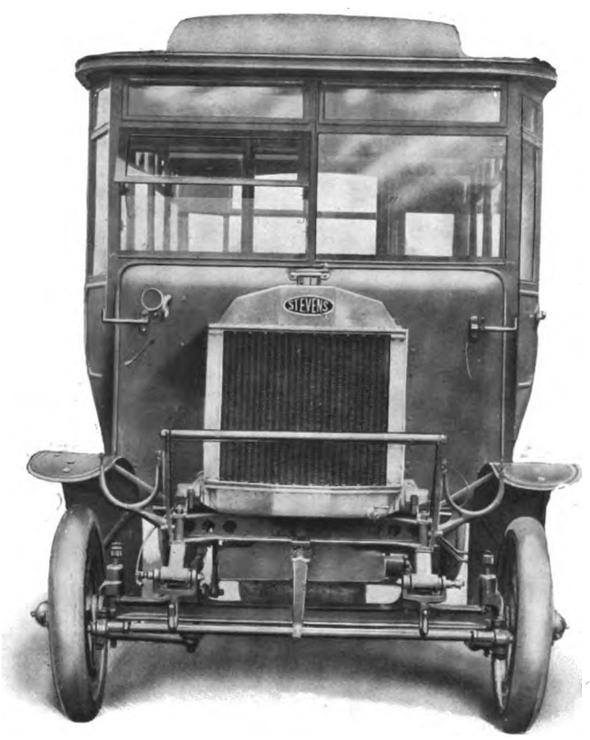

A "STEVENS" OMNIBUS RUNNING AT WALSALL

Greater comfort for Passengers Greater Tyre mileage, and Ease of Control

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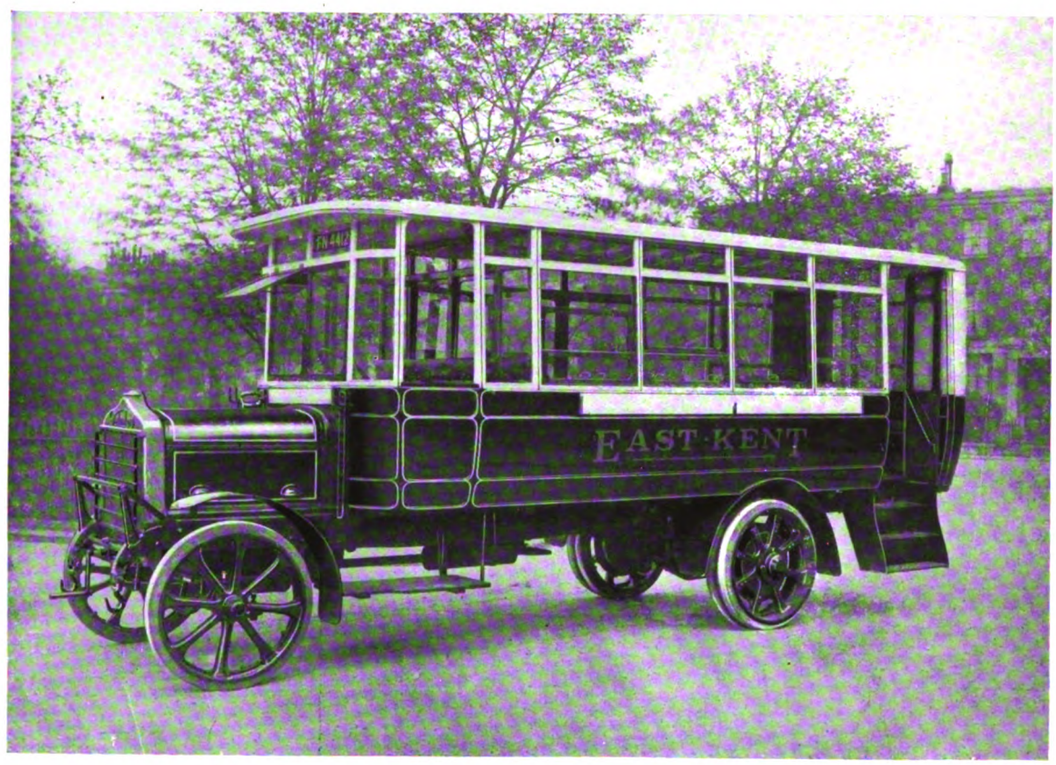
BIRCH BROS LTD

Single and Double-deck

MOTOR OMNIBUS BODIES



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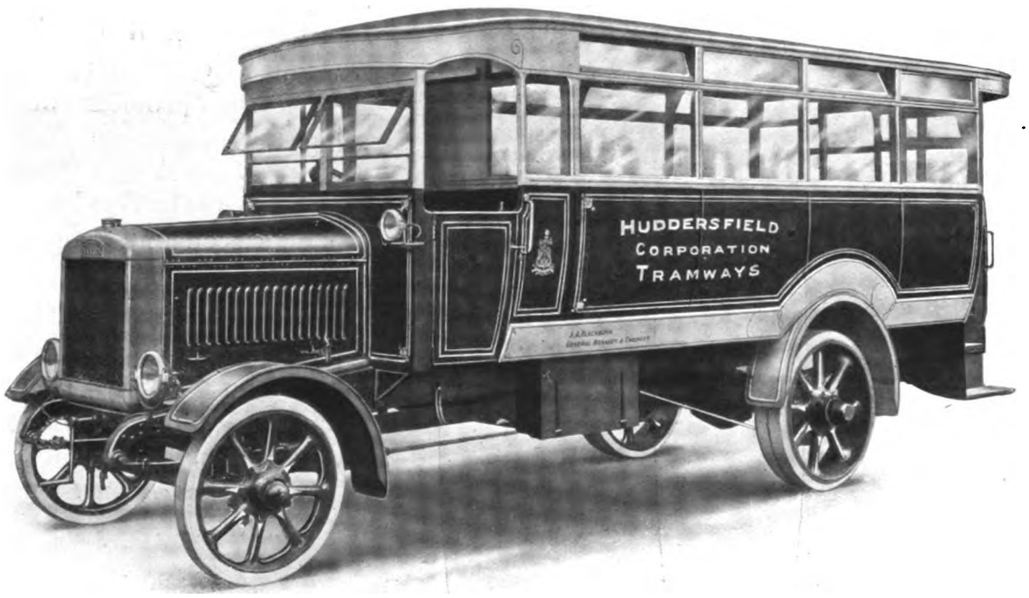

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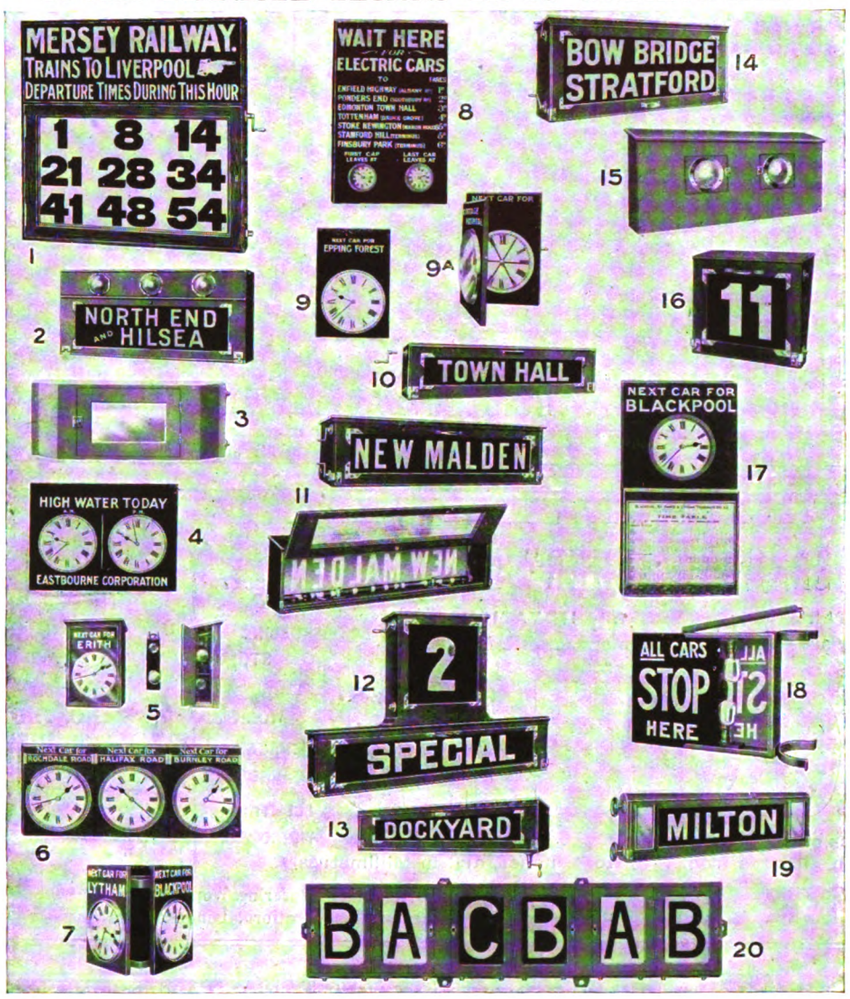

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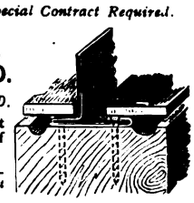

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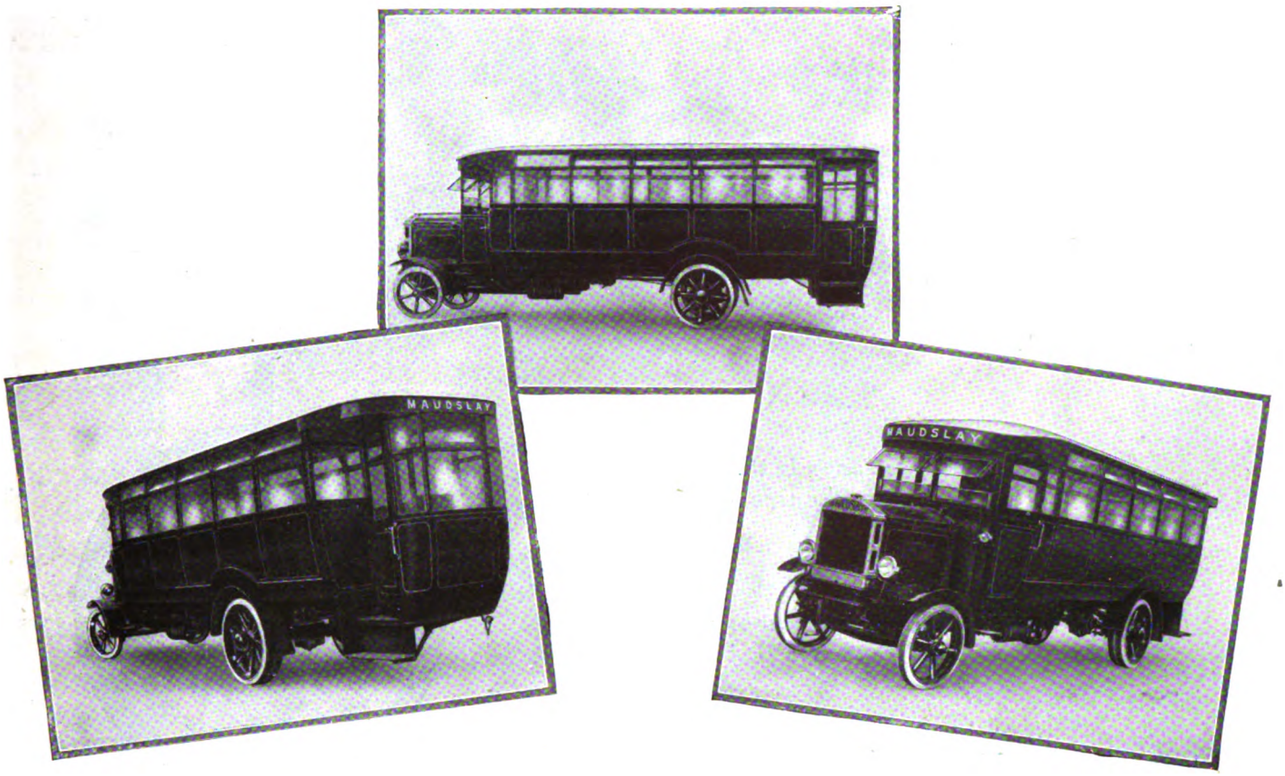

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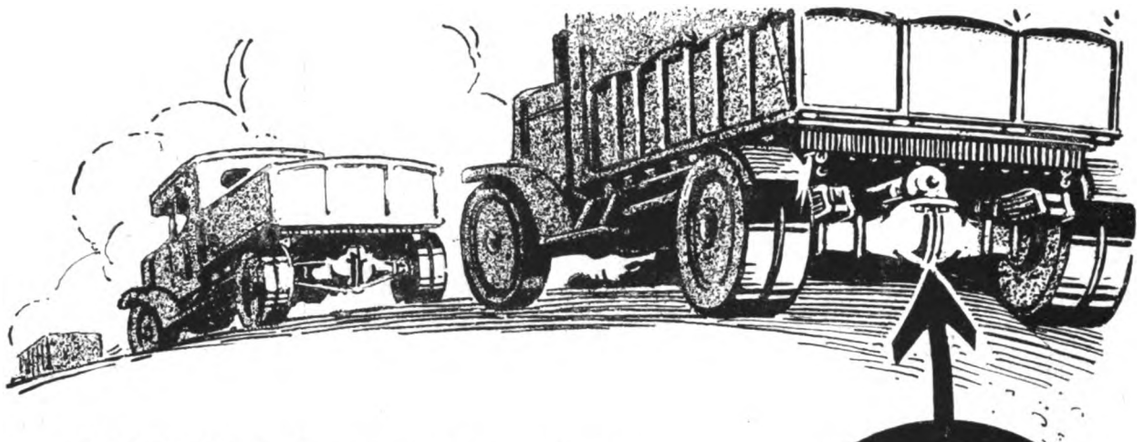

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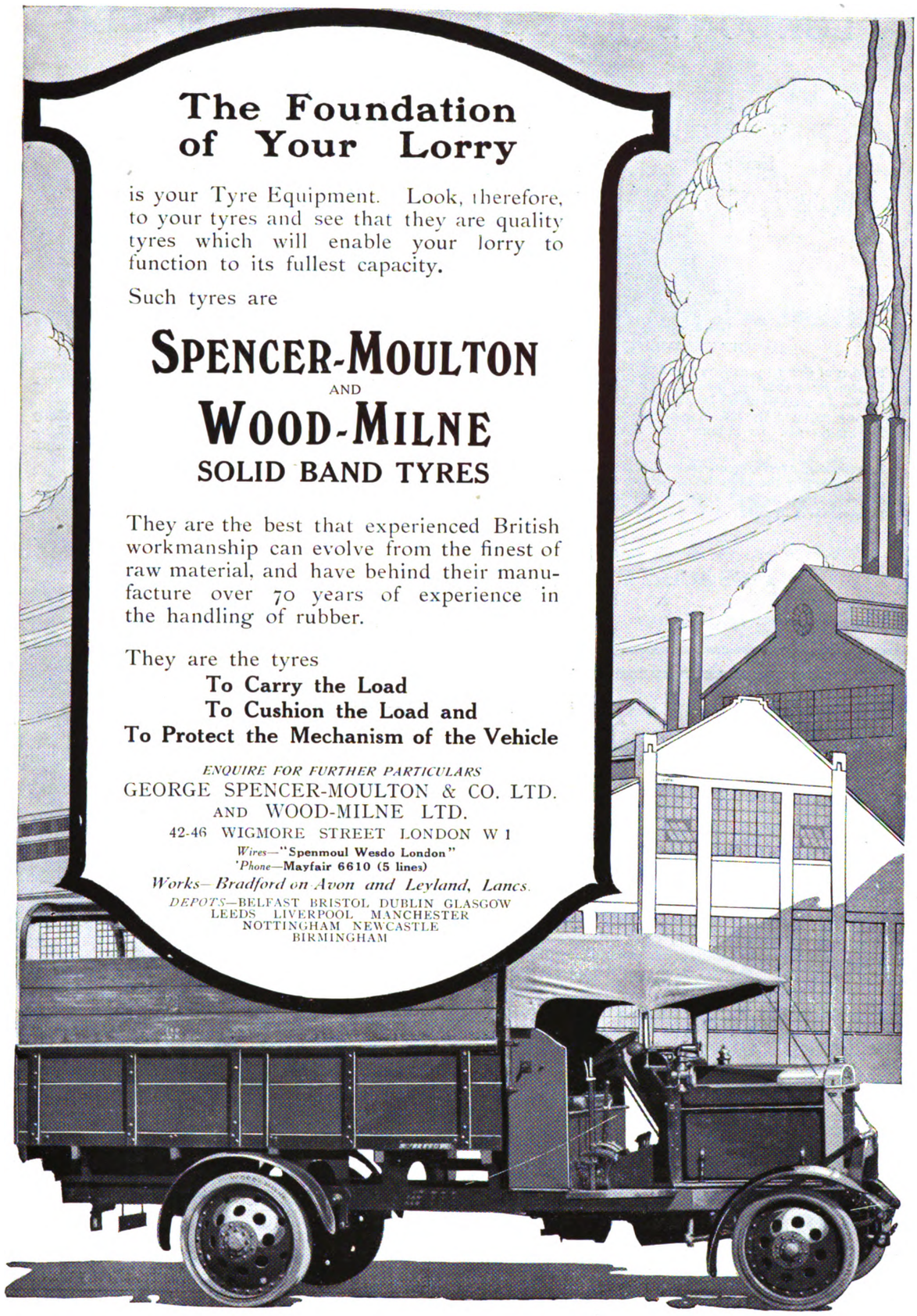

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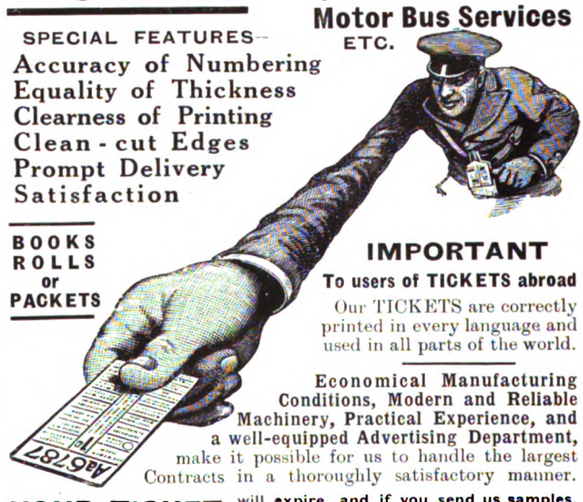

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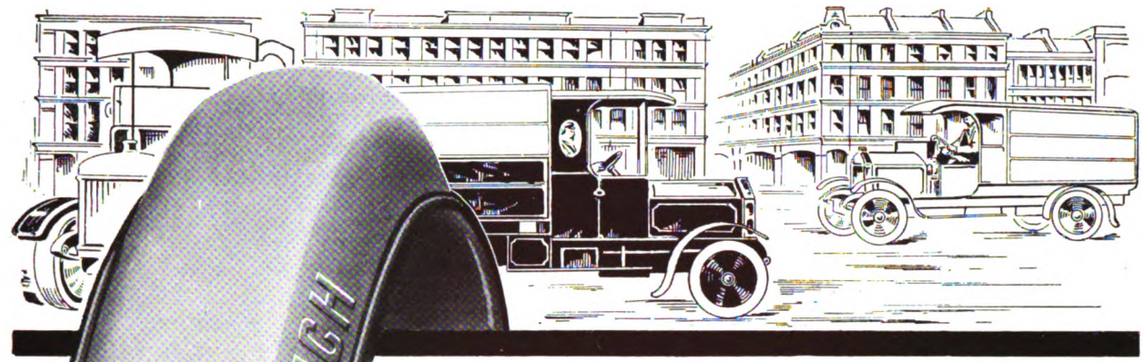

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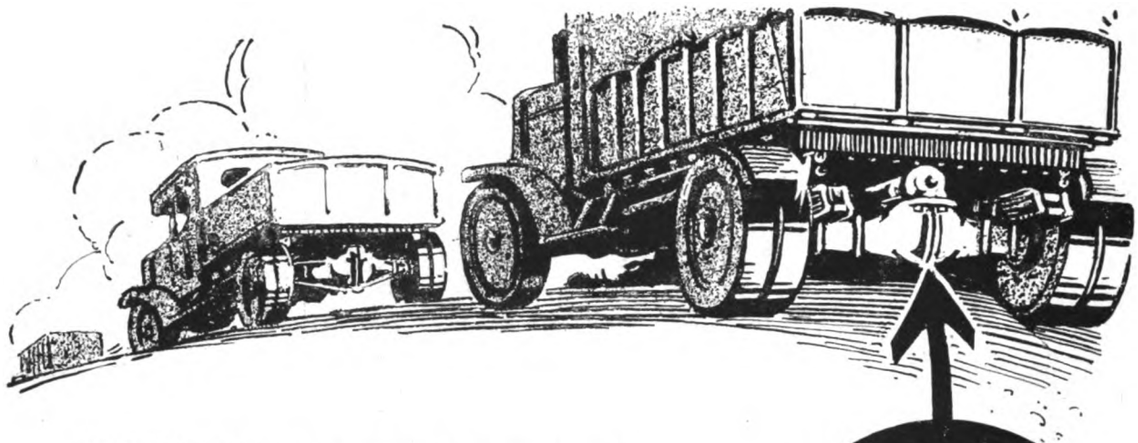

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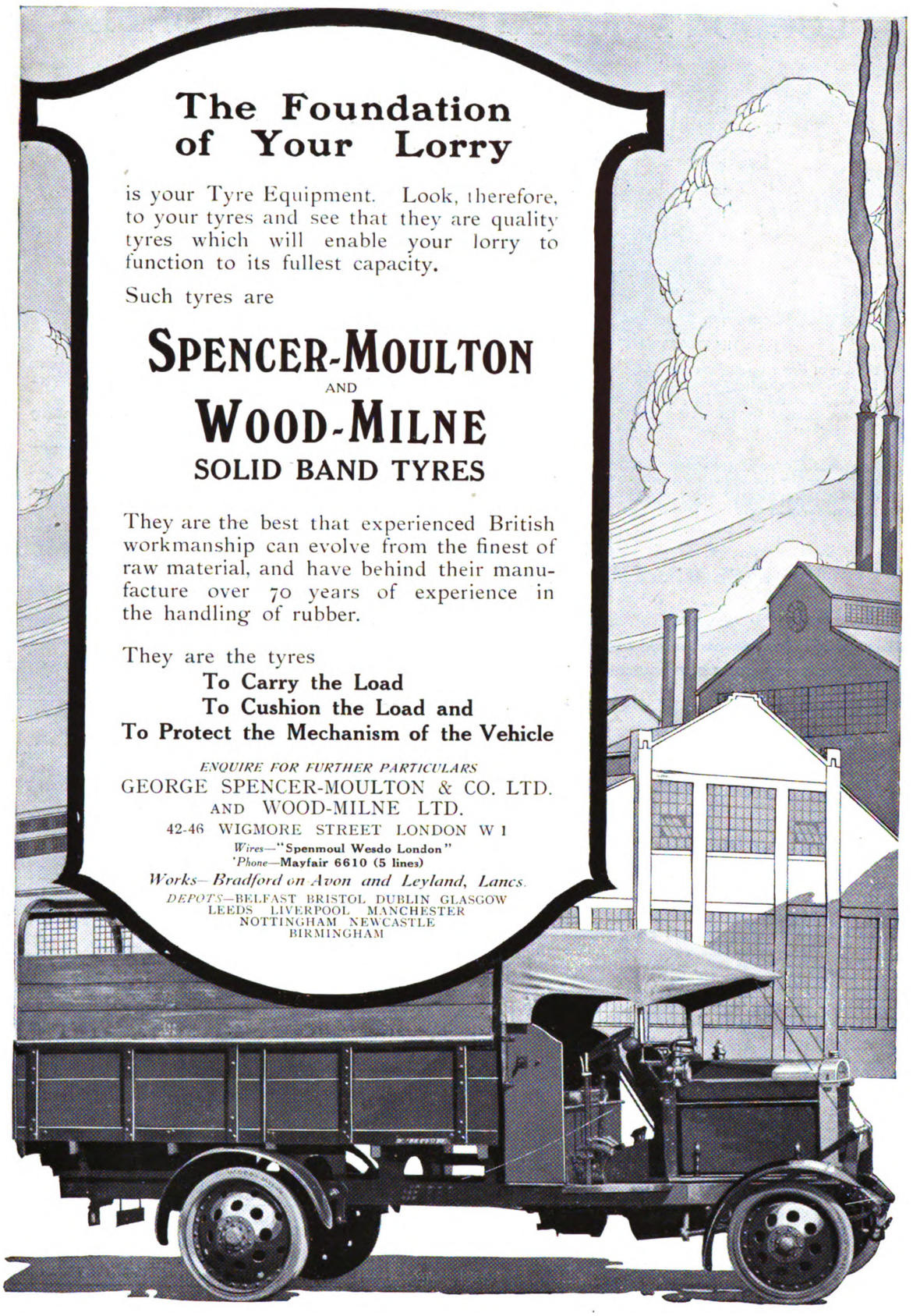

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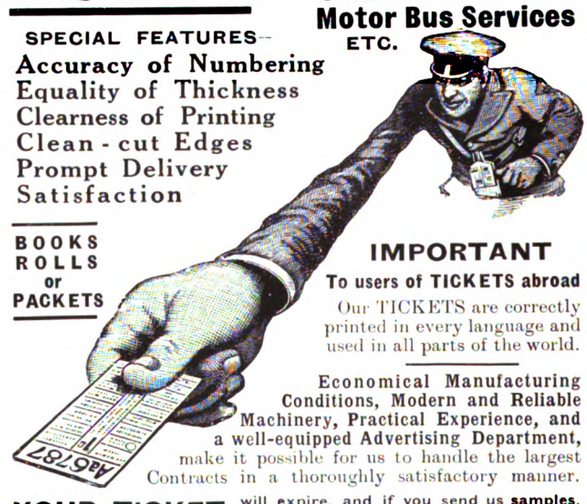

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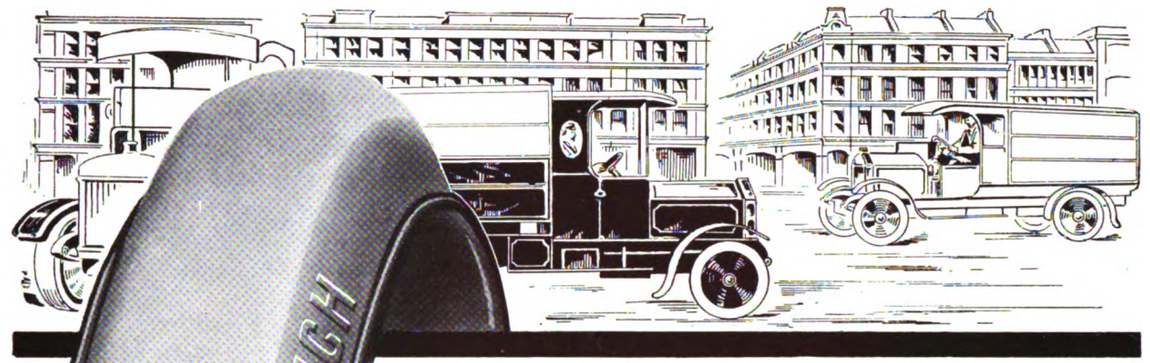

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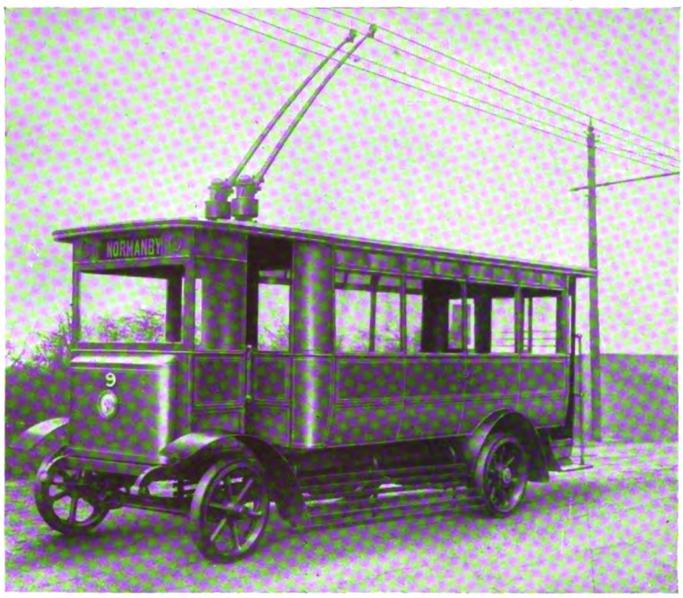

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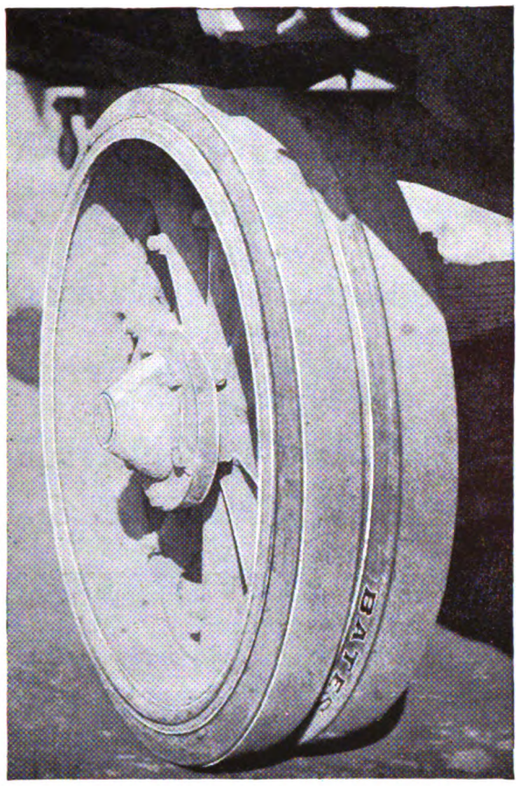

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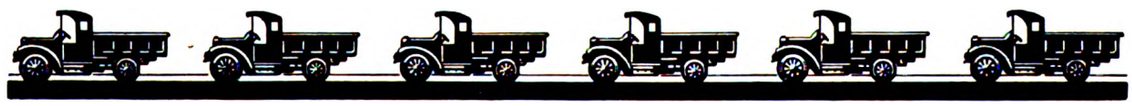

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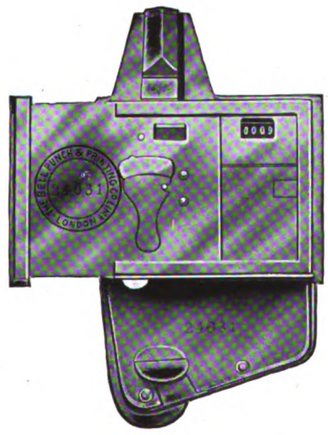

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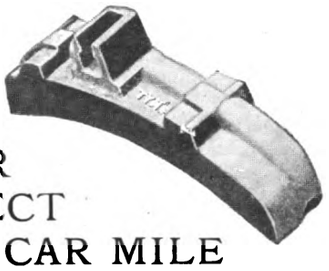

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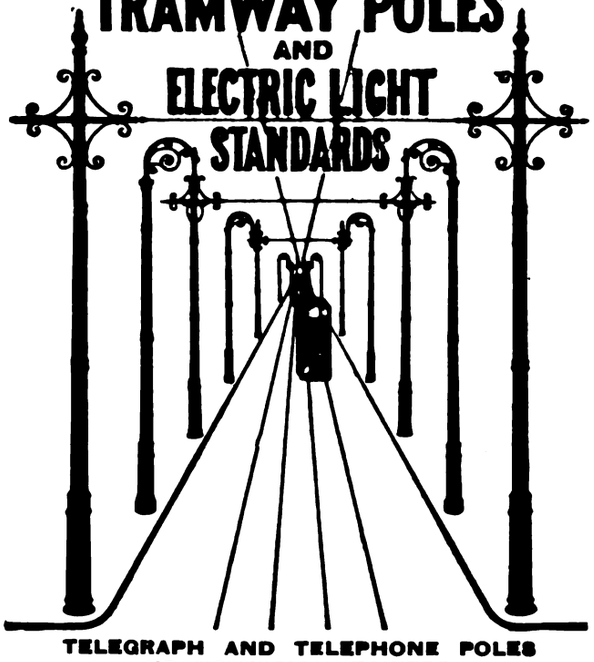

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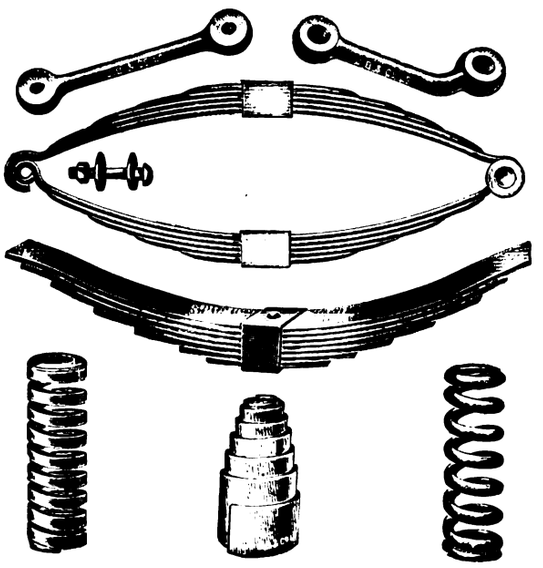

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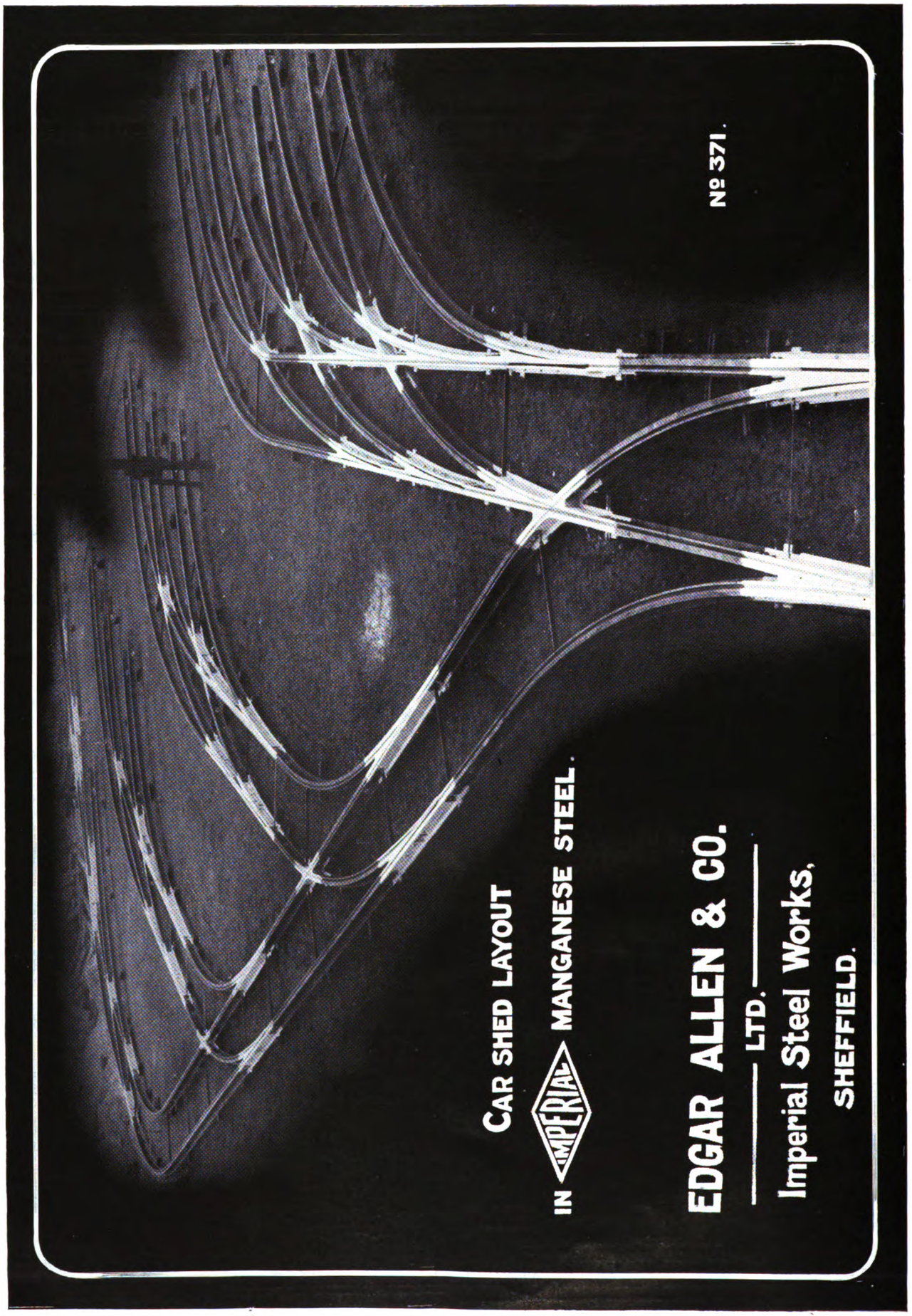

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